Toronto Transit
Commission

Environmental Assessment of Spadina Subway Extension

Prepared for

**Toronto Transit Commission and the
Municipality of Metropolitan Toronto**

DRAFT

by

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SPADINA SUBWAY EXTENSION
ENVIRONMENTAL ASSESSMENT

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E1 INTRODUCTION

This document provides a record of the study carried out for the Environmental Assessment of a northward extension of the Spadina subway line from the existing Wilson subway station to Sheppard Avenue. A terminal station with related facilities near the Sheppard Avenue/Allen Road intersection is also included in the undertaking.

The Environmental Assessment was authorized by Metro Council on April 26, 1989 following a review of their rapid transit plans and priorities, precipitated by the "Transportation Directions for Greater Toronto Area (GTA)" policy statement of the Ministry of Transportation of Ontario.

In April 1990 the Ministry also unveiled its Let's Move: Transportation Solutions for the 90's, policy statement, which included the joining of the existing Spadina and Yonge Street subway lines as part of the $5 billion program. Metropolitan Toronto endorsed the Provincial announcement in May 1990 in its Let's Do It: A joint TTC/Metropolitan Toronto Response and Implementation Strategy document. The Spadina subway extension, the subject of this environmental assessment, is an integral part of the Yonge-Spadina subway loop proposal.

An efficient transportation system is a pre-requisite for the sustaining of economic growth in Metropolitan Toronto and the Greater Toronto Area. Recent studies (listed in this executive summary) indicate that mounting levels of traffic congestion in the north Metropolitan Toronto area and projections of greater trip-making between North Metro and York Region are sources of increasing concern and constitute a growing problem.

The need for this undertaking, as an element of the solution to this problem, is assessed in Section E4 of this executive summary. Section E2 summarizes the process followed for the Environmental Assessment, and an outline of the existing conditions in the study area is provided in Section E3. The evaluation of alternatives to the proposed undertaking is discussed in Section E5. Following the conclusion that subway expansion best meets the need, the alignment alternatives for carrying out the extension are described in Section E6. The evaluation of the merits and environmental impacts of these alternatives is presented in Section E7 while Section E8 highlights the recommendations following the environmental assessment process.

EXECUTIVE SUMMARY

Many reports and studies have contributed to the analyses and findings of this Environmental Assessment. These are listed chronologically, below:

Planning Studies

- Regional Municipality of York. York Region Employment End Travel Survey. Engineering Department, 1986.
- City of North York. Retail and Service Commercial Policy Study. Long Range Planning Division, May 1987.
- City of North York. Sheppard West Study Background Report and Secondary Plan Alternatives. Long Range Planning Division, November 1987.
- City of North York. Official Plan. Consolidated to September, 1988.
- City of North York. Sheppard West Study: Report on Submissions and Proposed Secondary Plan. April, 1989. (The recommendations of study were deferred by North York Council.)
- Metropolitan Toronto Planning Department. Metropolitan Official Plan Review: Background Report No. 9 - Centres and Office Areas, 1989.
- Metropolitan Toronto Planning Department, Research Division, Population and Employment Forecasts, 1989.

Transportation Studies

- Toronto Transit Commission. Sheppard/Finch Rapid Transit Corridor Study Summary Report. May, 1985.
- Metropolitan Toronto Planning Department. West Metro Transportation Review. Transportation Division, May, 1986.
- Toronto Transit Commission, Factual Report - Sheppard RT Geotechnical Investigation, Phase 1, West Section, November, 1986.
- Transportation Tomorrow Survey, prepared for the Toronto Area Transportation Planning Data Collection Steering Committee, 1986.
- Cole Sherman Consulting Engineers & Architects. Sheppard Subway Wilson/Sheppard/Dufferin Study Area Function Design: Task #1 Alignment. for Toronto Transit Commission, July, 1987.
- Toronto Transit Commission. Sheppard Subway Functional Planning Review. August, 1987.

- Toronto Transit Commission. Impact Study of the Proposed Sheppard Ave. Subway. December, 1987.
- Transit Advisory Group to the Minister of Transportation for Ontario: Crossing the Boundaries, December 1987.
- Metropolitan Toronto Planning Department, Metro Cordon Count Program - 1987, Transportation Division, February, 1988.
- Metropolitan Toronto Planning Department. Northwest Metro Transportation Study. Transportation Division. March, 1988.
- Toronto Transit Commission. Network 2011 Final Report, June, 1986.
- Toronto Transit Commission. Yonge-University-Spadina Subway Improved Headway Study. August, 1988.
- Ontario Ministry of Transportation. Transportation Directions for the Greater Toronto Area. May, 1988.
- Metropolitan Toronto Planning Department. Metropolitan Official Plan Review: Report No. 6 - Central Area Transportation Issues, Transportation Division. August, 1988.
- Metropolitan Toronto Planning Department. Metropolitan Official Plan Review: Background Paper No. 8 - Metropolitan Roads. Transportation Division. August, 1989.
- Delcan Corporation: Sheppard Subway - Spadina Extension Property Protection Study, August, 1989.
- Toronto Transit Commission. Back to Basics: A TTC Strategy for the 1990's. May, 1989.
- Ministry of Transportation of Ontario. Summary - North Metro Boundary Transportation Review. April, 1990.
- Ministry of Transportation of Ontario. Let's Move: Transportation Solutions for the 90's. April, 1990.
- Municipality of Metropolitan Toronto. Provincial Rapid Transit Plans for the 1990's - A Joint Toronto Transit Commission/Metropolitan Toronto Response and Implementation Strategy. May, 1990

E2 ENVIRONMENTAL PROCESS

The requirements of an individual Environmental Assessment under Ontario's Environmental Assessment Act were met by following the process specified in the Ministry of the Environment Guidelines. Tasks undertaken as part of this process included:

- Data Collection
- Needs assessment and justification
- Identification and evaluation of alternatives to the undertaking
- Development of design alternatives for the undertaking
- Evaluation of design alternatives
- Description of the recommended alternative
- Identification of mitigation measures and monitoring mechanisms

In parallel with these tasks, an on-going public consultation program was implemented, consisting of three Public Information Centres and mailings of information material to interested parties. During the process, extensive consultation with a variety of government and private sector organizations was undertaken and regular review of study progress and application of technical considerations was achieved through meetings of a Technical Working Committee at approximately monthly intervals.

E3 EXISTING CONDITIONS IN THE STUDY AREA

Data on the existing conditions was collected to describe a set of existing natural and socio-cultural conditions against which environmental impacts of the proposed undertaking could be measured.

A **demographic analysis** of the primary and secondary study areas as well as the surrounding regions was carried out. The "Primary Study Area", straddling the Allen Road corridor between Wilson Ave. and Sheppard Ave., has had a stable population since 1981. However, in contrast to low growth (2.6% between 1981-1986) in Metropolitan Toronto, regional municipalities outside Metro grew by over 20%. The aging of the population, rising housing costs and the emigration of "baby boomers" are likely the primary influences on the slow or no growth trends within Metro Toronto and rapid growth in the remaining regions of the greater Toronto area.

Employment growth in Metro Toronto is exceeding projections and will greatly surpass the 2001 projection of 1.4 million jobs. Labour force statistics for 1986 indicated that, while Metro Toronto's employment opportunities exceed its resident labour force, the opposite is true for all other Regional Municipalities. This distribution reflects the inflow of workers to Metro from surrounding regions. The unexpectedly large increases in employment growth in Metro Toronto have not only been in the Central Area but more significantly in dispersed locations in the rest of Metro such as the North York "Centre" along Yonge Street. Increases in employment opportunities within York and Peel Regions have also been substantial in both absolute and percentage growth terms.

The **planning and policy context** is highlighted by recent statements made by the three levels of government participating in transportation and land-use planning related to the secondary study area. "Let's Move", the province's commitment to a continuous program of rapid transit development in the GTA for the 1990's, has, as a priority funding for a link of the Spadina and Yonge subway lines.

Metropolitan Toronto's Official Plan aims to create a multi-centered urban structure, which it states, can be achieved through the development of Metropolitan Centres located along rapid transit facilities. The City of North York, in its Official Plan promotes the establishment of an east/west rapid transit system in addition to the present north/south system. The City sees this transit expansion as supporting their objective to develop a central focal point of the city in the Yonge Street Centre area.

The existing **transportation** system in the study area consists of a network of arterial roads approximately 2 km apart forming a grid system north of Highway 401. The corridor for the proposed undertaking i.e., the Allen Expressway leading into Allen Road, dominates the system in the north/south direction. Results of the 1988 Northwest Metro Transportation Study showed that many of the intersections were operating at or near capacity. The study also noted that traffic growth on arterial roads is reducing the average operating speed of both cars and transit vehicles.

Transit routes in the study area focus on providing feeder service to the present Spadina Subway Terminal at the southern limit of the study area. Fifteen routes, all operated with standard 60 passenger buses, pass through the area. A.M. peak hour of passengers carried on Allen Road number approximately 2300. GO Transit operates one commuter train during the A.M. and P.M. peak hour on the CN Rail Newmarket Subdivision which runs north-south through the study area approximately 1 km west of Allen Road. The nearest station, however, is 12 km north of Sheppard Avenue.

Existing **land use** within the Primary Study Area is diverse, encompassing residential, commercial, industrial, institutional, air, road and subway transportation components. The Downsview Airport lands are particularly prominent. Residential land uses are largely single family with pockets of medium density development. Commercial/industrial development, for the most part abuts Sheppard Avenue and Allen Road to the north.

The northwest corner of the Allen Road/Sheppard Avenue intersection is vacant, privately owned property and Metro Toronto owns the southeast corner which is also vacant. Property in the northeast corner is privately owned and mainly residential although zoned for commercial use along Allen Road and Sheppard Avenue. The southwest corner is part of the Department of National Defence Downsview Airport property.

The **natural environment** of the study area consists of level-to-undulating topography with clay soils underlain by a till or boulder clay containing shale and limestone. Only scattered trees existed in the almost totally urban area with open, grassed field occupying vacant land between residential and airport property. Wildlife is confined to the "urbanized" group of small mammals and birds with no record of unusual or rare species. Drainage channels are intermittent features flowing only during spring thaw or heavy rainfall.

A review of records of the two Ministry of the Environment monitoring stations, straddling the study area, indicates that **air quality** is generally within the Ministry's ambient air quality criteria. Exceptions are ozone and suspended particles. The former is a regional problem and is generally not site-specific within an urban area. Personnel at the MOE reported that no complaints about odour have been lodged in the study area. This suggests that, at present, unpleasant odours are not experienced locally.

Ambient **noise** measurements at four locations in the primary study area indicate that sound exposure levels range from approximately 57 to 62 dBA during rush hour periods and in the low 50's for quieter times. These levels are presently exceeding the MOE criterion of 55 dBA for peak periods in residential outdoor spaces. Dominant sound sources are traffic on Allen Road and Wilson Heights Boulevard.

Vibration measurements were also taken in the study area to establish a base from which to evaluate projected levels after implementation of the subway extension. Results indicate that the ambient ground vibration in the study area is generally of a very low level i.e., well below the threshold of perception for mid-day and rush-hour periods.

An inventory of existing **Utilities** was developed through consultation with Consumers Gas, North York Hydro, Bell Telephone and the City of North York. While the detailed design of the subway extension would have to address any conflicts and relocation requirements, it is evident that no major utility installations would be impacted by subway construction. Also, previous studies have indicated a deficiency in the local sanitary sub-trunk sewer capacity. Improvements to the system in the study area to allow for further development are in the planning stages.

E4 NEEDS ASSESSMENT AND JUSTIFICATION

Overview of the problem:

Traffic congestion in the Greater Toronto Area (GTA) is affecting the capability of the road system to move people and goods effectively. Roads across the Metropolitan Toronto/York Region boundary are presently experiencing traffic volumes that are at, or approaching theoretical capacity. Metro Toronto, in reviewing its Official Plan concluded that "the limitations of improvements to the road system also necessitate that actions be undertaken to modify the propensity for automobile use".

The projected imbalance in population and employment growth for Metropolitan Toronto and surrounding regions (discussed in Section 4 of the document) points to the need for the transportation network to accommodate significant increases in inter-regional trips between York and Peel and Metro Toronto. Urban development such as the North York Centre, the Downsview Airport lands, should they be released, the York University area and the Sheppard Avenue/Allen Road node also suggests additional pressure on the road network.

Projections of trip growth made in the 1988 Northwest Metro Transportation Study indicated 110% growth across the western York/Metro boundary and 149% across the central portion, translating into an additional 20,000 trips per day across Steeles Avenue over the twenty year study period. The study also noted that approximately half of the York/Metro automobile trips are destined to North Metro (above Highway 401).

In a 1987 report of the Transit Advisory Group to the Ontario Minister of Transportation, it was noted that the share of the rapidly growing total cross-boundary trips carried by transit will have to increase significantly to avoid traffic chaos, since it is impractical to build enough new road lanes to carry the additional travellers by car.

Meeting Future Mobility Needs:

As has been suggested in several recent studies, improvement of the road system alone, is not an adequate response to the current levels of congestion and forecast travel demand in and around the Secondary Study Area. In the North Metro area, the major road improvements necessary are impractical as expansion of the corridors would be costly and disruptive to the existing built environment. In addition to these socio-economic issues, expansion of the road system raises several potential environmental concerns such as noise, exhaust emissions and visual intrusion.

Recognizing these limitations to improvement of the road system, the Provincial Government in its May 1988 policy statement on Transportation Directions for the Greater Toronto Area noted that "In order to meet future demands, we must balance the need for both roads and transit. Transit has played an essential part in the development of the GTA into the urban centre we know today - and it will have an even stronger role to play in the future."

This approach to meeting future mobility needs recognizes the several roles which a comprehensive rapid transit network fulfils in a metropolitan area. These include:

- providing an **efficient alternative to the automobile** by offering a fast, reliable, extensive network.

- providing a **"backbone" to the entire transit system** integrating street transit services into a unified network. The TTC's present rapid transit system is well known in this role of network integrator.

- offering **high speed urban links** to service high demand for improved access to major business and shopping districts. Metro Toronto's emerging multi-centred pattern demands these links even more so.

- **attracting riders from surrounding regions** with the ability to carry large numbers of passengers, mostly commuters between surrounding regions and the centres and sub-centres of the urban area.

Spadina Subway Extension - the Common Element of Network Expansion:

Numerous recent studies of transportation needs in the GTA have identified rapid transit network expansion options aimed at solving several existing and emerging mobility problems in north Metro and adjacent regions.

The Spadina subway extension is an important common element in most potential expansion options supported by the various concerned jurisdictions.

Exhibit 4.7.1 in Section 4 of the main report illustrates the relationship of this Undertaking to these options, which have been identified as having varying priorities. Options under consideration are:

- the Spadina-Yonge Subway Loop, an important component of the Rapid Transit Agenda for the 90s set out in the Provincial Government's document" Let's Move". Transportation Solutions for the 90s.

- a rapid transit facility on Sheppard Avenue, part of the recommendations of the joint Metro/TTC network 2011 report.

- an extension of the Spadina subway northwesterly, originally mentioned in the Province's 1988 "Transportation Directions" policy statement and now consolidated into their 1990 "Let's Move" initiative.

- a westerly extension of an east-west distributor corridor, a long term option identified in the North West Metro Transportation Study.

The foregoing assessment and justification leads to the following summary of the need for the Undertaking:

> Rapid transit expansion is needed to improve accessibility and mobility within north Metropolitan Toronto and across its boundary to York Region. This expansion will provide an integrated, cost effective, safe and environmentally sound transit alternative to balance on-going road improvement efforts and offset increased reliance on the automobile. The proposed undertaking is a pre-requisite for completion of a series of rapid transit network expansion initiatives currently under consideration for this study area.

E5 RAPID TRANSIT ALTERNATIVES TO THE UNDERTAKING

The Environmental Assessment Act requires the proponent to identify and evaluate alternatives to the undertaking, including the "do nothing" option. The need for rapid transit expansion defined previously has led to consideration of three rapid transit technologies deemed to be feasible for this undertaking and any subsequent expansion. These are the undertaking itself, i.e. subway (Toronto Transit Commission's existing heavy rail system); light rail transit (LRT) and a busway network of the type in use in Ottawa.

The use of each of these alternatives in the study area and as a rapid transit network in north Metro was investigated and the merits of each evaluated using criteria developed to measure their ability to respond to the defined need. Details of this evaluation are presented in matrix form in Table 5.1 in Section 5 of the main report. This evaluation resulted in the following conclusions:

- Subway technology offers the most reliability as it is totally separated from traffic, rarely affected by inclement weather and permits frequent, on-time service.

- While all technologies are able to maintain or improve present trip times to some degree, extension of the existing subway system minimizes time loss due to transfers from one system to another and maximizes the portion of the trip length at the highest transit operating speed.

- The convenience provided by expansion of the existing subway network, eliminating transfers and offering a greater portion of the journey at improved ride comfort levels makes it the most attractive alternative to use of the private car.

- Subway technology has the most flexibility to respond to future growth in travel demand and provides greater opportunities for system expansion such as the Yonge-Spadina Loop initiative, which offers an increase in capacity on the existing Yonge subway line.

- Although all technology options constitute an alternative to automobile use, an expanded subway network is easier to market as a faster, more convenient option.

- Subway expansion largely underground minimizes the disruption to existing land uses and communities and by reducing congestion on arterial roads it helps alleviate local mobility and accessibility problems.

- While all rapid transit technologies aim for high levels of safety and security, subways minimize the risk by eliminating the interface with other modes and vulnerability to weather-related accidents. Fewer transfers also reduces the security risk.

- Of the rapid transit alternatives, subway technology is the most environmentally sound and energy efficient alternative to the increasing pollution problems generated by traffic congestion.

- Expansion of the subway is highly compatible with the planning and transportation policy objectives of provincial, Metro Toronto and North York jurisdictions.

- Although subway expansion is the most capital-intensive of rapid transit options, it has proven to be the most cost-effective over the life of the facility due to its operating costs being lowest.

The above conclusions of the evaluation confirm that the proposed Undertaking, Subway extension is the technology best able to respond to the need for rapid transit expansion.

E6 ALIGNMENT AND STATION ALTERNATIVES

This phase of the environmental assessment consisted of a review of previous studies and further development of alignment and station concepts. After consultation with TTC staff and the Technical Working Committee, eight alignment alternatives were identified as being worthy of feasibility design and subsequent evaluation. Six of these, Alternatives A1 to A6, require passengers to transfer between an extended Spadina line and a possible Sheppard line by changing trains at a Sheppard Avenue/Allen Road station. The remaining two alternatives, B1 and B2, permit movement from one line to another on the same train through integration of service.

The **characteristics of the alignment alternatives**, shown in the exhibits in Section 6.0 of the document, are summarized in the following descriptions:

- **Alternative A-1** makes use of existing tracks on the east side of the TTC's Wilson Yard for the first 650 metres of its length. When the Spadina line to Wilson station and the Wilson Yard were constructed, these tracks were configured to permit further subway extension to the north. From the north end of the yard, the alignment continues on the west side of Allen Road on DND property to a station beneath the Sheppard Avenue/Allen Road intersection. The station would be depressed to permit construction of a future grade separation at the intersection.

- **Alternative A-2** also utilizes existing yard tracks to the yard north boundary from where it traverses DND property to a skew crossing of Allen Road approximately 400 metres south of Sheppard Avenue. After passing under Allen Road, it continues north to an underground station in the southeast quadrant of the intersection on Metro Toronto property.

- **Alternative A-3** is an alignment reflecting the implications of remaining west of Allen Road throughout the undertaking. It follows the same route as A-1 and A-2 through the Wilson Yard from where it deflects slightly to the west continuing north on DND property to Sheppard Avenue. The subway would be entirely underground from the crossing of the airport runway to a station on privately-owned property in the northwest quadrant of the Sheppard/Allen intersection.

- **Alternative A-4** illustrates alignment opportunities on the east side of Allen Road. This alternative occupies the median of Allen Road between Wilson Station and the Transit Road intersection instead of following the route through Wilson Yard. After passing under Transit Road, it continues northward in an open cut on the east side of Allen Road crossing Metro Toronto property presently being protected for transit purposes. An underground station similar to that proposed for A-2 would be located in the southeast quadrant of the Sheppard Ave./Allen Road intersection.

- **Alternative A-5** again utilizes the easternmost tracks within Wilson Yard to the northern yard boundary. At this point, it is curved sharply to the east in order to cross under Allen Road opposite the end of the Downsview Airport east-west runway. From the underpass the subway would continue northward in an open-cut across Metro Toronto property, paralleling Allen Road on the east side. Approximately 300 metres south of Sheppard Avenue it would enter an underground station with terminal facilities again in the southeast quadrant of the intersection.

- **Alternative A-6** is an option which assumes that Allen Road is reconstructed to a divided arterial cross section thus providing a median for use as a subway right-of-way. From Wilson Station, this alignment follows the existing median to Transit Road where it is depressed to cross the intersection. Continuing north in a new median, it would end at a station immediately south of a grade separated Sheppard Avenue. This station, similar to Lawrence West station on the existing Spadina Line, would have platforms in the Allen Road median and an elevated walkway from terminal facilities in the southeast quadrant.

- **Alternative B-1**, permitting service integration with a future Sheppard line, also passes through Wilson Yard before swinging first to the northwest and then back eastward in a loop under the Downsview Airport. This loop aligns the Spadina subway into an east-west orientation parallel to Sheppard Avenue permitting a station in the southeast quadrant of the Allen Road intersection. At the east end of the station, the line could continue eastward as a Sheppard subway.

- **Alternative B-2** also permits service integration with a Sheppard line. This is achieved without a loop on DND property but requires placement of the Sheppard/Allen station further south from Sheppard Avenue to accommodate a sharp curve to the east on Metro Toronto property in the southeast quadrant of the intersection. From Wilson station this alternative follows the route of alignment A-2 through Wilson Yard, across DND land and under Allen Road. The station would be partially under the road with terminal facilities east of the road allowance.

Station concepts developed for each of the alignments fall into two main categories. A "cross-station" configuration, where the Spadina line and a future Sheppard line would cross in an approximately perpendicular arrangement, is appropriate for Alternatives A-1 to A-6. For Alternatives B1 and B2, the "parallel" layout is feasible since both subway lines would be aligned in the same direction at the station location. This latter arrangement allows either a vertical transfer between trains or a horizontal "across-the-platform" transfer depending on the layout of the tracks through the station. All station concepts include the necessary mezzanine level, a bus terminal on the surface, a passenger pick-up and drop-off facility linked by tunnel to the mezzanine and parking for up to 1000 cars.

E7 EVALUATION OF SUBWAY ALIGNMENT ALTERNATIVES

In accordance with the requirement of the Environmental Assessment Act to evaluate "alternative methods of carrying out the undertaking", the following methodology was adopted to evaluate the eight alignment alternatives:

- a series of evaluative criteria were developed in consultation with the Technical Working Committee. These fall into five main **(Factor)** groups, namely, transportation, social environment, bio-physical environment, land-use and cost.

- a comparative evaluation was carried out to rank the relative merit of each alternative with respect to the above criteria. The ranking system consisted of four levels of either performance of the alignment, or impact on the environment depending on the criteria being considered.

  The scales adopted were:

Performance	Impact
- Very good	No impact
- Good	Low impact
- Fair	Moderate impact
- Poor	High impact

- where the ranking process revealed little or no difference between alternatives for certain criteria, these criteria were screened out of the evaluation and a discussion of the impact or performance was included in the document text.

- following the evaluation, the rankings were analyzed and the trade-offs and key differences, between the two highest ranked alternatives from the unweighed analysis, examined more closely.

The criteria used consisted of the following **sub-factors** of the five main factor groups:

- Transportation

  A Mainline Track Alignment (Design Geometrics)

  B Convenience of Service Connections

  C Efficiency of New Sheppard/Allen Terminal Operations

  D External Accessibility of Sheppard/Allen Terminal

  E Internal Terminal Circulation

- Social Environment

  A Construction

  B Vibration (Operation)

  C Noise (Operation)

  D Electromagnetic Interference

  E Air Quality

F Flexibility of Expansion of Network

G Impact on Immediate Study Area Road Network

H Failure Management Capability

I Mainline Track Alignment

- Bio-physical Environment

A Contaminated Soils

B Soil Erosion

C Run-off/Drainage

- Cost

A Property Acquisition Costs

B Construction Costs

C Operation and Maintenance Costs

D Future Expansion Cost

F Visual Impact

G Safety

H Security

I Heritage/Archaeology

- Land Use

A Consistency with Planning Policies

B Immediate impact on Adjacent Properties

C Impact on Future Land Uses

E7.1 Results of the Unweighted Analysis

Considering **Transportation** sub-factor rankings in total, Alignments A-2 and A-3 are the highest ranked alternatives. Alternative A-2 performs marginally better in mainline track alignment, internal terminal circulation and flexibility for future network expansion, while A-3 is placed higher against criteria covering external accessibility of the station terminal and study area road network impact. Both alternatives are considered equal in respect of convenience of service connections and terminal operational efficiency.

The evaluation of flexibility for future network expansion has addressed the subway expansion initiatives outlined in the Provincial Government's Let's Move: Transportation Solutions for the 90's policy statement. Alignments A-2 and A-3 do not preclude these expansion opportunities.

Analysis of the **Social Environment** sub-factor rankings reveals that alignment A-3 has the lowest impact during construction, minimizes visual impact and is considered among the safer of the eight alternatives. Noise and vibration impacts of the highest ranked alternatives, A-2 and A-3 are assessed as low and can be mitigated. The effect on air quality resulting from terminal operations in either of the preferred locations is predicted to be minimal. Alignments A-2, A-3, A-5 and B-2 are ranked as safest because the station configuration minimizes patron circulation distances and elements. Security is considered good for all alternatives. Electromagnetic Interference (EMI) with DND installations, as a result of subway operations across the Downsview Airport property, were investigated and found not to be a concern for any of the alternatives.

Biophysical Environmental Impacts were studied and found to be minor or possible to mitigate in the areas of concern, viz. disposal of contaminated soils, erosion of existing soils and vegetation and control of stormwater run-off.

Evaluation of Land Use - related Impacts has shown that all alternatives are consistent with the planning policies of the provincial and local governments. Also none of the options involves a loss of employment or housing or adverse affects on access to adjacent properties.

The impact of the extension on future uses of DND land and Metro Toronto-owned property for residential/commercial/other purposes was also assessed. All alignments except A-4, A-5 and A-6 provide "good" adaptability for future use, the exceptions inhibiting access from lands west of Allen Road.

In assessing the difference in future development potential of the subway terminal options, two scenarios were considered, i.e. integration of terminal facilities into other future developments, or no integration with future developments. The evaluation determined that the potential for integration could be good on both southeast or northwest station sites although success on the latter would hinge on favourable negotiations with a private owner. Construction of the station without integration would be straightforward on the south-east quadrant but would require acquisition of the site on the northwest.

Consideration of all the sub-factors measuring the **Costs of the undertaking**, reveals that alternatives A-2, A-3 and A-5 are predicted to have the lowest overall costs. Alignment A-5 achieves the absolute lowest capital cost because of a poor quality alignment minimizing property acquisition. The other two alternatives, offering more long term benefits and operational advantages, fall in the same capital cost range of $160 - 180 million. Although A-3 property acquisition costs are reflected as being higher, savings could result if station terminal property acquisition negotiations are favourable and low-cost underground easements from DND can be obtained. Also, the more convenient feeder bus access to a northwest quadrant terminal (proposed for A-3) will result in lower operating costs for the extension. For the purpose of this environmental assessment, property acquisition costs for both northwest and southeast station sites are assumed to be equal. This assumption was necessary because there is no way of knowing what actual negotiated costs would be. Consequently, the cost comparisons do not reflect any advantage of the A-2 station being on Metro-owned land potentially available at a much lower cost or any favourable opportunities related to private sector investment for the A-3 station facility.

E7.2 Findings of the Evaluation

From the comparative evaluation of the eight alternative alignments against the five primary factors, Alignment alternatives A-2 and A-3 have clearly emerged as those which minimize environmental impact and respond best overall to performance requirements. A further analysis of key differences between alignments A-2 and A-3 yields the following:

- **Transportation**

Alignment A-2:	Alignment A-3:
- has a marginally better track alignment.	- results in better external accessibility for feeder buses.
- permits marginally better internal terminal circulation.	- has a lower impact on the existing and future road network.
- provides slightly better connections to a possible future yard east of Allen Road.	

Both alignments offer flexibility for expansion of the subway network as proposed in the recent Provincial Government announcement and do not preclude the options identified for further study. These opportunities are illustrated in Exhibit 7.3.1 and are discussed further in Section 7.3 of the main report.

- **Social Environment**

Alignment A-3 will have a lower impact on the social environment because:

- the infrastructure is further removed from residential neighbourhoods.
- construction is totally west of Allen Road reducing dust, noise, vibration and traffic concerns.
- the station in the northwest quadrant is in a commercial/industrial area.

- **Bio-Physical Environment**

- No major differences in impact were identified. Impact in all areas is predicted to be low or non-existent.

- **Land Use**

The impact will be generally similar for both alternatives A-2 and A-3. Present ownership of the proposed station terminal site is the only key difference.

- **Cost Of The Undertaking**

The property acquisition cost for Alignment A-3 is marginally higher.

Construction costs for both alignments are in the same range with A-3 estimated to be marginally higher.

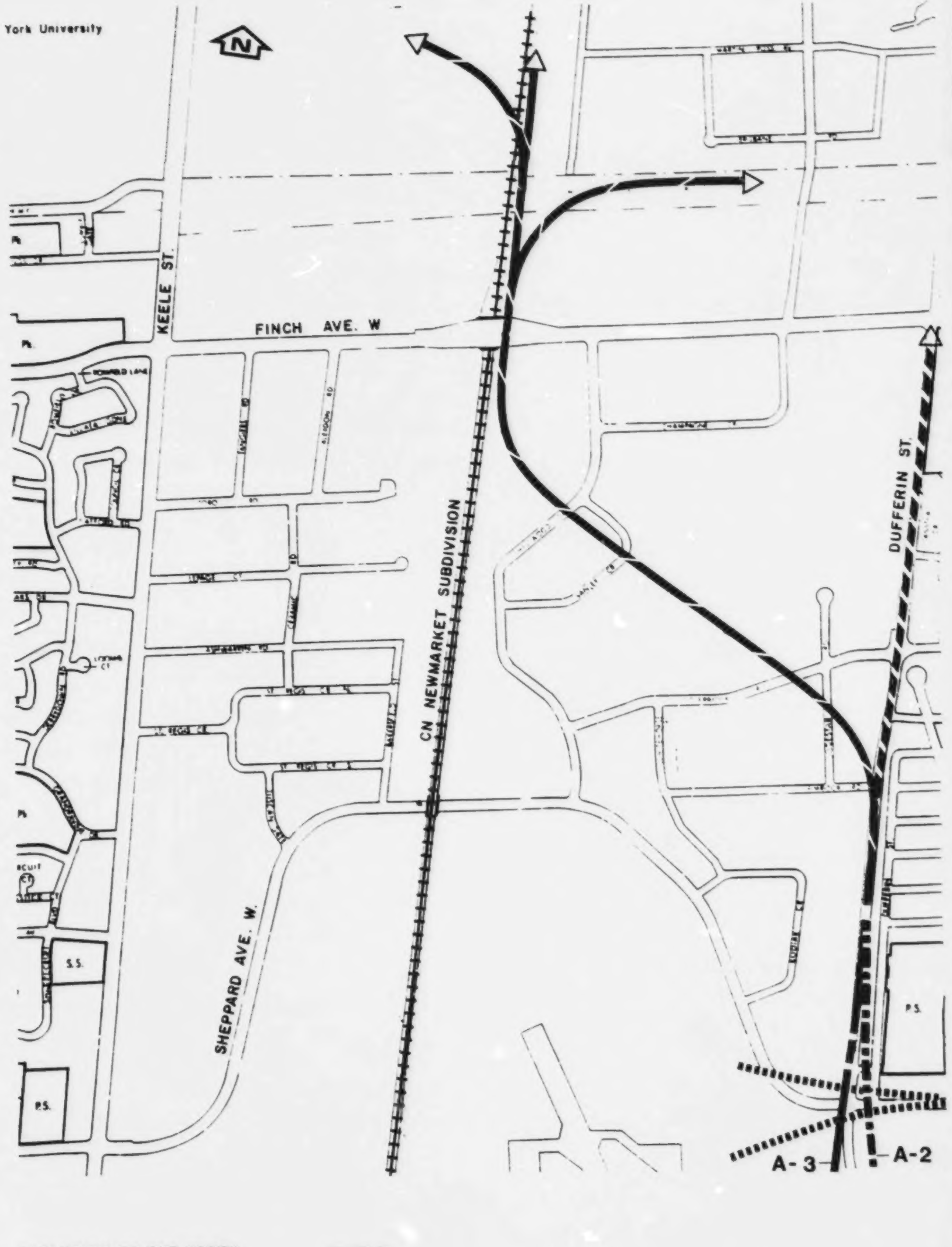
Operating and Maintenance costs for A-3 will be lower mainly due to better bus access.

E8 RECOMMENDATIONS

- From the analysis of key differences it is evident that alignment alternative A-3 offers greater benefits to the public and the proponent than does A-2 hence implementation of Alternative A-3 should be pursued.

- MOE approval of both alternatives should be requested because of the following implementation concerns.

    - Cost and time for land acquisition and potential for integrated development.
    - North York planning approvals and development scheduling.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DUFFERIN ST.
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Pk.
A-3
A-2

EXPANSION TO THE NORTH ▬ ▬ ▬

EXPANSION TO THE NORTHWEST ▬▬ ▬

EXPANSION TO THE EAST OR WEST ▪▪▪▪▪▪▪▪

OPPORTUNITIES FOR FUTURE EXPANSION

EXHIBIT 7.3.1.

1.0 INTRODUCTION

1.1 Background

Metropolitan Toronto's subway system began in 1954, when the 7.4 km Yonge Subway line from Union Station to Eglinton Avenue was opened. Since then, the Toronto Transit Commission's (TTC's) repid transit system has grown to 63.9 kilometres.

The need and impetus for additional expansion has emerged in large part as a result of Metropolitan Toronto's Official Plan or "MetroPlan[1]". Adopted in 1981, MetroPlan emphasizes the need for decentralization of urban development along the rapid transit system. The intent is to ensure that a more human scale of urban development occur, rather than the Manhattan-style development inherent in a centralization scenario.

A number of transportation studies were undertaken over the four years following adoption of the Plan, among them:

- Accelerated Rapid Transit Study (ARTS) - 1982;
- Eglinton West Rapid Transit Study (EWRT)- 1983;
- Sheppard/Finch Rapid Transit Corridor (SFRT) study - 1983;
- Downtown Rapid Transit Study (DRT) - 1985.

The findings of these studies reflected concern that without expansion of the system, the decentralization aims of the Official Plan would not be realized and that congestion would grow increasingly worse, since Metro's capacity for roadway expansion is limited. With all of these studies recommending rapid transit expansion for their respective corridors, it was clear by 1985, that there was a need to establish system priorities.

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[1] Metropolitan Toronto. Official Plan for the Urban Structure(September, 1981) Sections 4, 5 and 6.

SECTION 1 - INTRODUCTION

In June, 1986 Network 2011, prepared jointly by the Municipality of Metropolitan Toronto and the Toronto Transit Commission (TTC), set out a 25 year rapid transit strategy for Metropolitan Toronto. The strategy was the result of careful review of the transportation needs of Metropolitan Toronto and of extensive input provided by Metropolitan Toronto Area Municipalities, other Metro agencies and neighbouring regional and local municipalities.

The report recommended, in part, that the Sheppard Subway should be the first rapid transit priority, and that the section from Yonge Street to Victoria Park Avenue should be completed first. At that time, Metro Council approved implementation of this first priority phase of the proposed Sheppard Subway (the whole of which was intended, ultimately, to extend from an extension of the Spadina subway up Allen Road in the west to the Scarborough Town Centre in the east) conditional on the following:

- Approval of the project under the Environmental Assessment Act;
- Approval of the necessary Official Plan amendments; and
- Agreement by Ontario's Ministry of Transportation to provide a 75 per cent Provincial Subsidy for the capital cost of the line.

In May, 1988, The Ontario Ministry of Transportation's (MTO's), Transportation Directions for the Greater Toronto Area(GTA) set out the Province's recommended course for transportation investment in the GTA. While recommending protection of the Sheppard subway alignment, the report stated that "an extension of the Spadina Subway northerly towards York University will be pursued[2]".

This provincial Directions announcement precipitated a Metropolitan Toronto review of its rapid transit plans which resulted in a revision to its priorities for the construction of the Sheppard Subway line. The segment of the Spadina subway line from Wilson Station to Sheppard Avenue became the priority over the Yonge Street to Victoria Park segment. **Authorization to proceed with the Environmental Assessment for this Wilson Station-Sheppard Avenue segment was given by Metro Council on April 26, 1989 and is the subject of this document.**

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[2] Ontario Ministry of Transportation. Transportation Directions for the Greater Toronto Area. (May, 1988) p.13.

In April, 1990 the Ontario Ministry of Transportation unveiled its Let's Move: Transportation Solutions for the 90's, "announcing Ontario's full support for an immediate continuous program of rapid transit expansion in the GTA[3]".

First on the list of initiatives identified as part of the $5 billion program was the Yonge-Spadina subway loop, that is, the joining of the existing Spadina and Yonge Street subway lines into a single system in the Finch-Steeles area:

> "A major component of our transit agenda is the Yonge-Spadina subway loop...We consider this an essential element for moving people across the North Metro-York Boundary."[p.4]

In May, 1990, Metropolitan Toronto endorsed the Provincial announcement in its Let's Do It: A Joint TTC/Metropolitan Toronto Response and Implementation Strategy[4] which stated that:

> "Since the proposed initiatives are consistent with Metropolitan and TTC objectives and plans, the TTC and Metropolitan Toronto should accept, in its entirety, the 10-year rapid transit plan contained in the recent 'Let's Move' Provincial announcement."[p.4]

1.2 Purpose of the Study

An efficient transportation system is a pre-requisite for the sustaining of economic growth in Metropolitan Toronto and the Greater Toronto Area (GTA). As later sections of this document will indicate, mounting levels of traffic congestion in the north Metropolitan Toronto area and projections of increased trips between north Metro and York Region are sources of increasing concern and prospect a problem. The purpose of this study is to conduct an environmental assessment of an undertaking which contributes to the solution of this problem.

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[3] Let's Move: Transportation Solutions for the 90's. Ontario Ministry of Transportation - Remarks by the Honourable William Wrye, Minister of Transportation (April 5, 1990) p. 2.

[4] Toronto Transit Commission & Municipality of Metropolitan Toronto. Let's Move: A Rapid Transit Agenda for the 1990's - Let's Do It: A Joint TTC/Metropolitan Toronto Response and Implementation Strategy. Published in April, 1990 and adopted by the Council of Metropolitan Toronto at its meeting held on May 9, 1990.

The following is a **Statement of the Need for this Undertaking**:

> Rapid transit expansion is needed to improve accessibility and mobility within north Metropolitan Toronto and across its boundary to York Region. This expansion will provide an integrated, cost-effective, safe and environmentally sound transit alternative to balance on-going road improvement efforts and to offset increased reliance on the automobile.
>
> This Undertaking would be the common link to a series of rapid transit expansion options currently in planning stages and essential to an ultimate transit network envisaged by Metropolitan Toronto, the City of North York and the Province of Ontario. The Undertaking is a vital component of these jurisdictions' plans to meet future public transit needs.

The undertaking constitutes a northward extension of the Spadina rapid transit service from Wilson Station to Sheppard Avenue and comprises the construction and operation of an extension of the Spadina subway, including a terminal station with related facilities near the Sheppard Avenue/Allen Road intersection. The terminal includes all ancillary facilities to permit pedestrian and vehicle access, including a widening of Sheppard Avenue, bus transfers, passenger pick-up and drop-off and park'n'ride.

Opportunities from implementation of this Undertaking include:

- Continued development of the transportation infrastructure necessary to support the primary objectives of the Metropolitan Toronto Official Plan.

- Relief of pressure on the north-south road system by improving transit market share.

- Extension of rapid transit network accessibility and provision of associated travel time savings to a larger segment of the Greater Toronto Area.

- Provision of opportunities for improved linkages to inter-regional transit.

- Provision of an alternative to automobile use in a zone of the Greater Toronto Area where traffic demand is expected to exceed possible expansion of the road system.

A detailed assessment of the need for the Undertaking incorporating a justification is presented in Section 4.0.

2.0 STUDY APPROACH

2.1 Environmental Assessment Process

In order to fulfill the requirements of an individual Environmental Assessment under Ontario's Environmental Assessment Act, a process outlined below and shown on Exhibit 2.1, has been followed:

- **Study Design** - This component includes the purpose of the study, either a problem to be solved or an opportunity to be obtained. It also includes design of the planning process, including selection of evaluation methods and the public involvement program.

- **Data collection** - Material relating to past, existing and likely future conditions was assembled. Both primary and secondary source information was collected. The multi-disciplinary nature of the analysis entailed assembly of data addressing the socio-cultural and natural environment, land use trends and policies, transportation patterns and policies, transit operations, costs, utilities, noise, electromagnetic interference (EMI), vibration, air quality, soil quality and environmental guidelines,.

- **Need assessment** - Based on an analysis of pertinent planning and policy documents, an assessment of the need for the undertaking was undertaken.

- **Identification and evaluation of alternatives to the undertaking** - Four alternatives to the proposed undertaking, including "do nothing", improvements to the road system, a busway system and Light Rail Transit (LRT), were evaluated. Through this evaluation it was determined that the proposed undertaking, i.e subway extension, was the preferred method to satisfy the need.

- **Development of design alternatives** - A range of eight alignments was developed for the proposed undertaking by carrying out the necessary preliminary design. This defined the operational and environmental characteristics of a reasonable number of alternatives.

- **Evaluation of alternative designs** - The impacts of each design were determined and evaluated against a set of factors, indicators and measures. The major factors, detailed later in this report, included transportation, social environment, biophysical environment, future land use, and cost. The preferred alternative(s) from this analysis was selected.

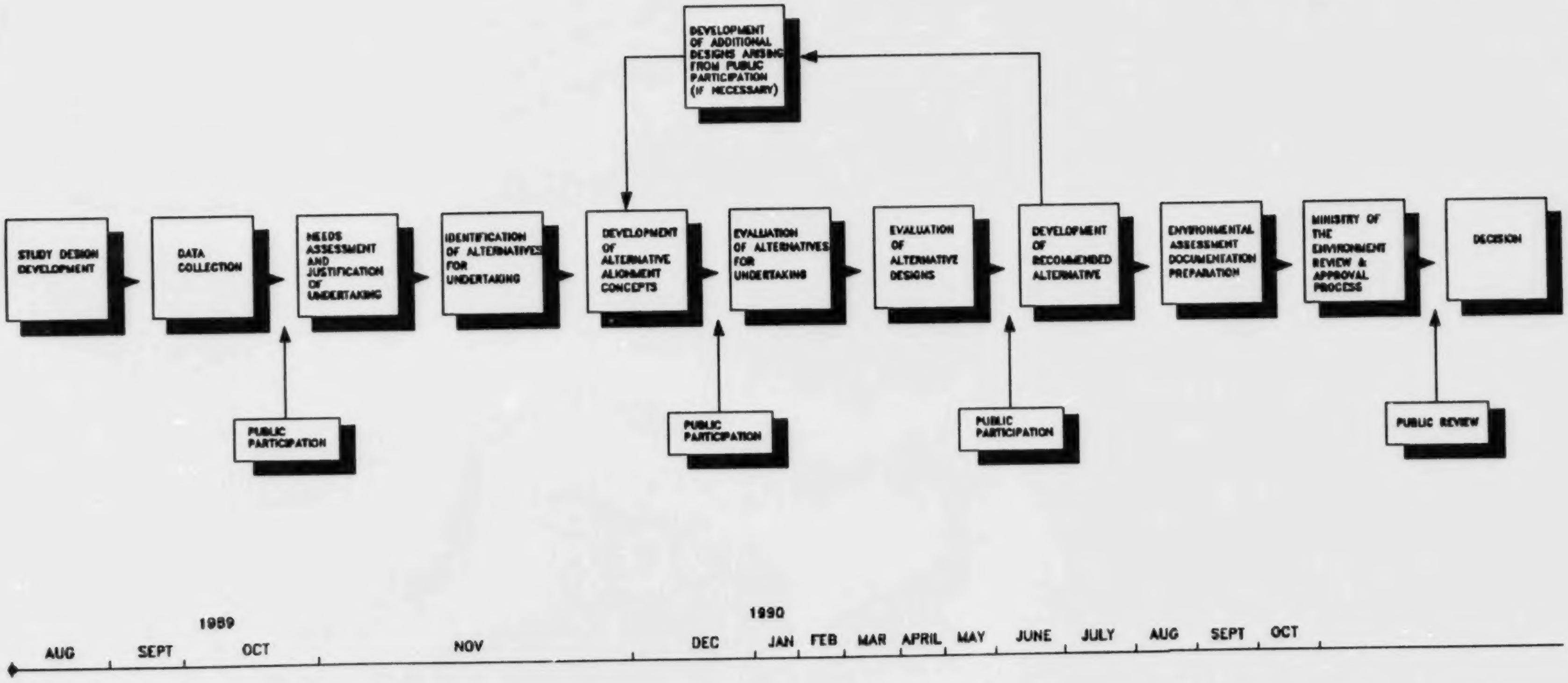
- **Mitigation and monitoring** - Means of mitigating any adverse effects of the proposed undertaking were developed, and monitoring mechanisms were recommended.

- **Public Involvement Program** - As part of the Environmental Assessment, extensive consultation with a variety of government and private sector organizations was undertaken. In addition, an on-going public consultation program was an integral part of this process. These two elements of consultation are briefly reviewed below.

2.2 External Involvement

General direction of the consulting team was provided by the Technical Transportation Planning Committee (TTPC). A Technical Working Committee (TWC) was established to provide regular review of study progress and application of technical considerations within the Environmental Assessment (EA) Process. Membership was derived from agencies directly affected by the proposed undertaking and included representatives of the following organizations:

- Toronto Transit Commission - Environmental Assessment and Research;
- Toronto Transit Commission - Systems Engineering;
- Toronto Transit Commission - Corporate Planning;
- Metropolitan Toronto Planning Department;
- Metropolitan Toronto Transportation Department;
- City of North York Planning Department;
- City of North York Transportation Department;
- Ministry of the Environment of Ontario (Environmental Assessment Branch);
- Ministry of Transportation of Ontario; and


STUDY DESIGN DEVELOPMENT
DATA COLLECTION
NEEDS ASSESSMENT AND JUSTIFICATION OF UNDERTAKING
IDENTIFICATION OF ALTERNATIVES FOR UNDERTAKING
DEVELOPMENT OF ALTERNATIVE ALIGNMENT CONCEPTS
EVALUATION OF ALTERNATIVES FOR UNDERTAKING
EVALUATION OF ALTERNATIVE DESIGNS
DEVELOPMENT OF RECOMMENDED ALTERNATIVE
ENVIRONMENTAL ASSESSMENT DOCUMENTATION PREPARATION
MINISTRY OF THE ENVIRONMENT REVIEW & APPROVAL PROCESS
DECISION
DEVELOPMENT OF ADDITIONAL DESIGNS ARISING FROM PUBLIC PARTICIPATION (IF NECESSARY)
PUBLIC PARTICIPATION
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SPADINA SUBWAY EXTENSION

ENVIRONMENTAL ASSESSMENT

STUDY PROCESS

EXHIBIT 2.1

- Regional Municipality of York Engineering Department.

On average, the committee has met with the consulting team on a monthly basis to monitor on-going progress, to provide supporting information and to review the findings and recommendations of each phase.

Additional approving bodies and agencies outside of those repesented on the TWC have had input to this process through meeting presentations or informal information displays. These included:

- Metro Council - 2 information displays and a presentation.
- TTC Commissioners - 1 presentation.
- Joint Metro/TTC Technical Transportation Planning Committee and Sub-committee - 4 presentations.
- TTC Executive Committee, Engineering and Construction Committee and Design Committee - 6 presentations.
- Department of National Defence - 2 meetings.
- Boeing Canada - 1 meeting.
- Metro Parks and Property - 2 meetings.
- Idomo Limited (N.W. quadrant property owners) - 5 meetings .

2.3 Public Participation

An integral component of the environmental assessment process is public consultation. In this case, three Public Information Centres (PIC's) were held. These informal sessions are convened to give the public an opportunity to meet and question the consulting team, to review the development and evaluation of alternatives, and to express their opinions with respect to environmental and other relevant matters related to the proposed undertaking.

Specifically, the following steps were taken to ensure adequate public consultation:

- The intention of the TTC to undertake the Environmental Assessment, was announced in the Toronto Globe & Mail, Toronto Star, Toronto Sun and North York Mirror newspapers.

- Over 2,000 letters were distributed to residents within the Primary Study Area inviting them to attend the three Public Information Centres convened over the course of the study (October 26, and December 12, 1989 and June 11, 1990) and held at Faywood Elementary School in the primary study area.

- Letters were distributed to all Metropolitan Toronto and North York Councillors notifying them of these same Public Information Centres.

- Notices of the Public Information Centres were also sent to an extensive list of stakeholder associations or organizations as well as numerous ministries or departments of all levels of government with potential interest in the undertaking. (**A copy of this mailing list** is included in Appendix 2.3 of this assessment).

- At least one week prior to each PIC, announcements were placed in the newspapers, listed previously.

- The three Public Information Centres were convened and information was provided in the form of display boards and handouts. While the first PIC provided general information regarding the environmental assessment process and the proposed undertaking, the second PIC provided findings regarding existing conditions, the need and justification for the proposed undertaking and possible design alternatives. The third and final PIC documented the results of the evaluation of alternatives to the proposed undertaking; development of design alternatives; evaluation (ranking) of alternatives; and presentation of preferred alternatives. 53 members of the public attended the first information centre, most of whom expressed support for extension of the subway system. Many requested information on future planning or public centres. Attendance at the second centre was 26 from whom 8 comment sheets were received. The third information centre was visited by 50 persons. Useful feedback on the evaluation of the alignment alternatives was obtained from the 20 comment sheets submitted at the meeting.

A more detailed record of the information centres and a list of Exhibits displayed at the Information Centres is provided in Appendix 2.3 of this assessment.

- Personal contact with ratepayer organizations by the consulting group was also undertaken in February, 1990 to ensure that such groups felt adequately informed and involved in the public consultation process. This included all ratepayers groups in City of North York wards three, five and seven, provided by the North York Public Information Centre and verified through respective ward councillors. Correspondence and Ratepayers lists are provided in Appendix 2.3 of this report.

A detailed list of members of the public and Agencies receiving prior contact with notification of Public Information Centres is also provided in Appendix 2.3.

3.0 EXISTING CONDITIONS

The purpose of this portion of the study is to describe a set of existing natural and socio-cultural conditions against which impacts of proposed changes can be measured and mitigated.

3.1 Definition of Study Area

In order to further the aims of the Environmental Assessment process, two study areas have been defined, within which existing conditions and potential impacts of the proposed Undertaking have been assessed.

For the purposes of assessing the immediate socio-economic and bio-physical effects (effects on vegetation, wildlife, noise and vibration levels, utilities, etc.), a "Primary Study Area" (see Exhibit 3.1.1) has been defined and encompasses the area within 500 metres of the Sheppard Avenue/Allen Road intersection and 500 metres on either side of Allen Road between Wilson and Sheppard Avenues.

A "Secondary Study Area", shown on Exhibit 3.1.2, provides a much broader geographical context within which to assess socio-economic trends and possible future effects of completion of the proposed Undertaking.

3.2 Social Environment

3.2.1 Demographic Trends

The following review of historic trends within the Primary and Secondary Study Areas provides a basis for projecting future population growth and assessing associated transportation requirements.

The Greater Toronto Area (GTA)

Data relating to the GTA, namely Metropolitan Toronto, York, Durham, Peel and Halton Regions, provide a basis for the following demographic and employment-related analyses.

Between 1971 and 1986, the GTA grew from roughly 2.1 million to 2.9 million people. As Table 3.2.1 shows, much of this growth occurred outside of Metropolitan Toronto.

While Metro accounted for only 103,000 of the population increase, Durham, York and in particular, Peel Regions, experienced the largest growth, much of it occurring between 1981 and 1986. Over this five year period, Metropolitan Toronto experienced growth of 2.6%, while regional municipalities outside Metro grew by over 20%[1].

Of the total increase in population over the 1971-1986 period (812,800), 41% went to Peel Region, 22% to York Region, 24% to Durham and Halton Regions combined, and the remaining 13%, to Metropolitan Toronto. While net in-migration underscored population growth in the outlying regional municipalities, the trend in Metropolitan Toronto between 1971 and 1986 was, in contrast to out-migration, offset by natural increase.

North York experienced its greatest population growth in the 1960's, during which it grew from 269,950 to 504,150, or by 87%[2]. Between 1971 and 1981, the growth rate fell to 10%, and between 1981 and 1985, population in absolute terms, actually dropped marginally.

It is likely that the aging of the population, rising housing costs and the emigration of "baby boomers" to other areas, have been primary influences on the slow/no growth trends within Metro Toronto and the rapid population growth in the remaining Regions of the GTA.

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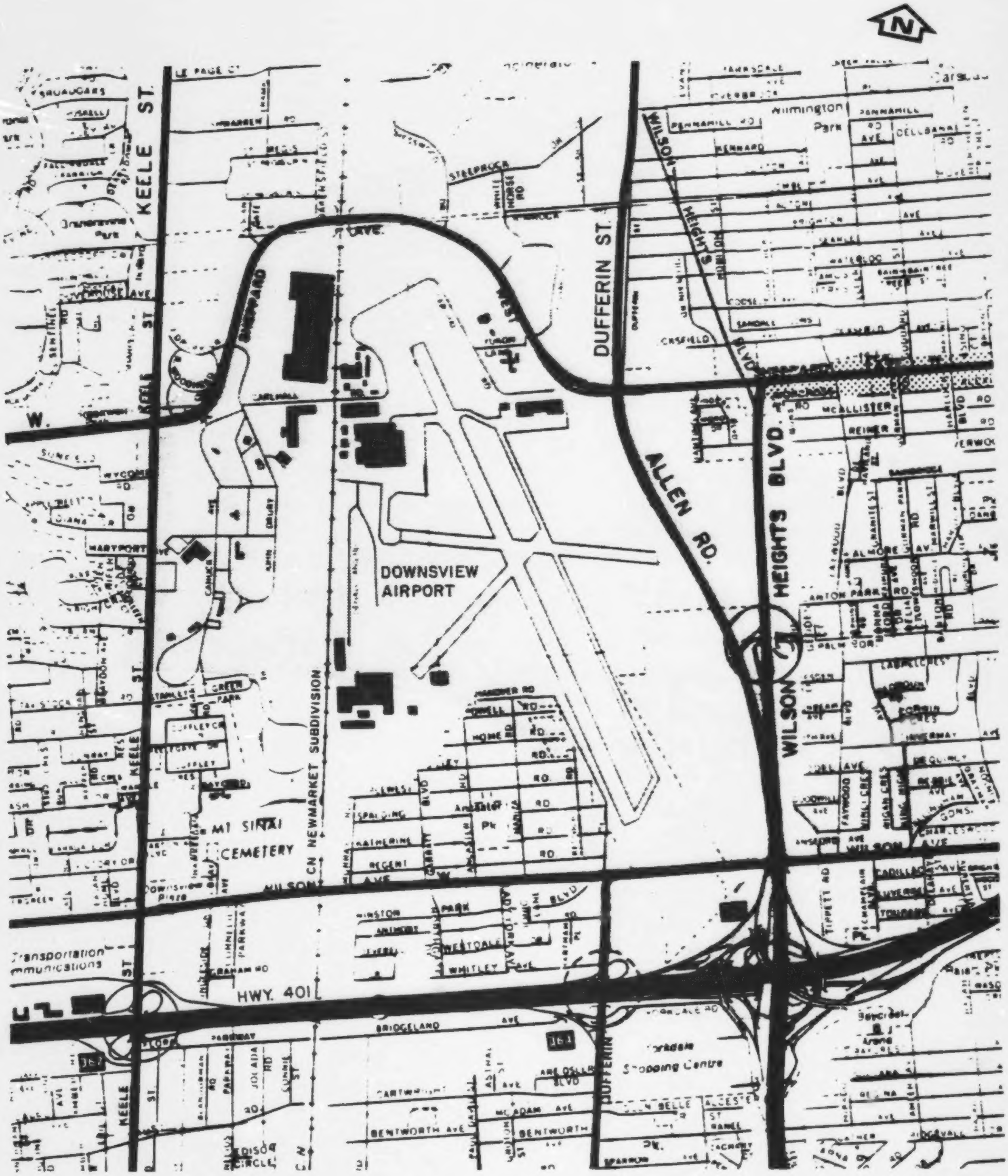
[1] Municipality of Metropolitan Toronto. Metropolitan Plan Review. Report No. 8, 1989. (p. 15).

[2] City of North York. Retail and Service Commercial Policy Study. Long-Range Planning Division, 1987 (p.27).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WILSON AVE
HWY. 401
Wilmington Park
Yorkdale Shopping Centre
BRIDGELAND AVE
CARTWRIGHT
BENTWORTH AVE
McALLISTER
REINER
ANTON PARK
CARL HALL RD.
Transportation Communications
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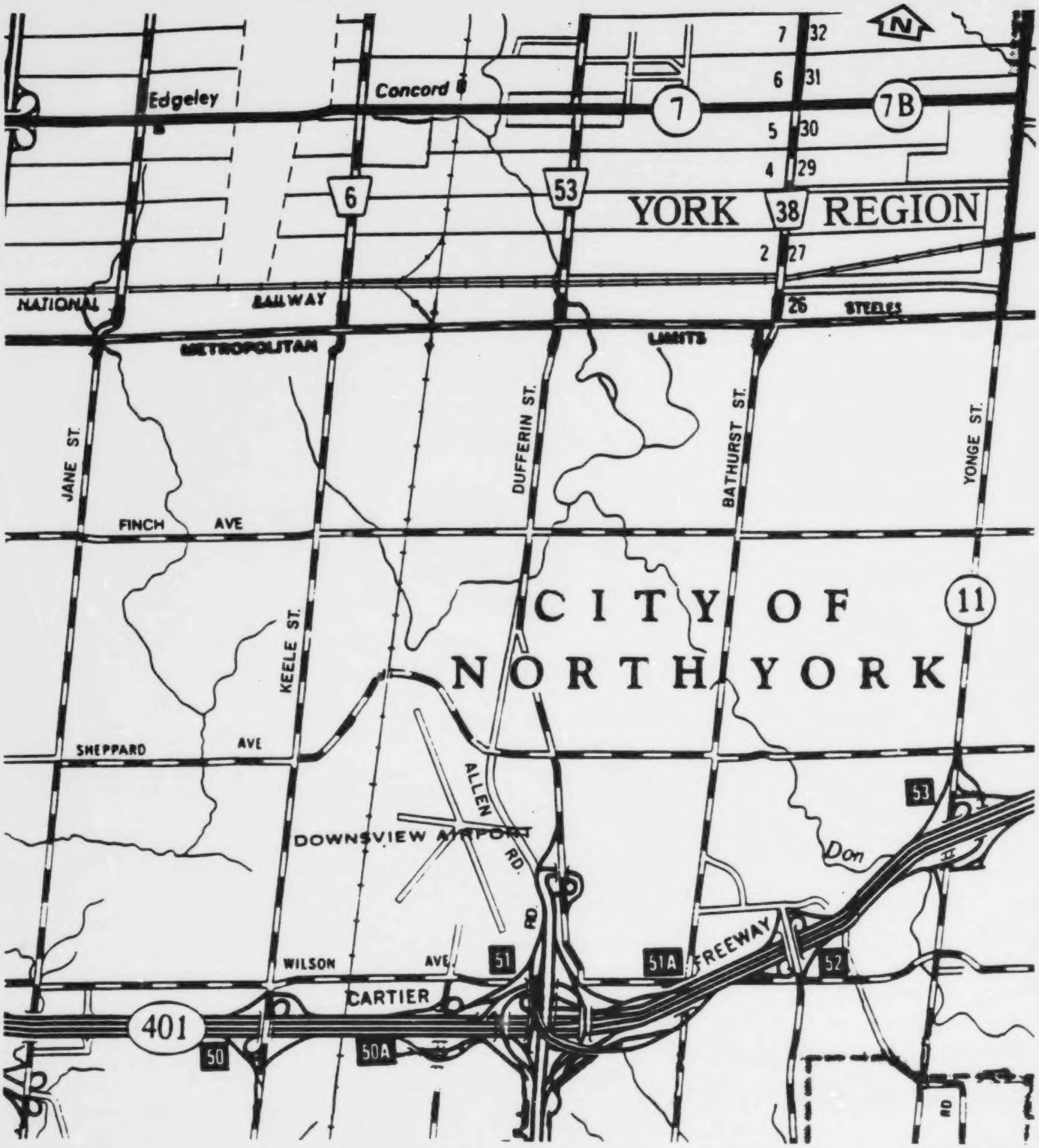
361

PRIMARY STUDY AREA ▨

PRIMARY STUDY AREA

EXHIBIT 3.1.1.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CITY OF NORTH YORK
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FREEWAY
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CARTIER
401
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SECONDARY STUDY AREA

EXHIBIT 3.1.2.

TABLE 3.2.1
POPULATION AND EMPLOYMENT BY EACH OF FIVE REGIONS IN THE GREATER TORONTO AREA (GTA)
1971 - 1986

Region	1971	1981	Change % / % pts.	1986	Change % / % pts.
Metro Toronto					
• Population	2,089,729	2,137,395	2.3%	2,192,721	2.6%
• Growth (1971-1986)	-	-	-	102,992	-
• Share of GTA population	71.6%	62.5%	-9.1pts	58.7%	-3.8pts
• Employment	-	1,240,000	-	1,320,000	6.5%
• Employment as per cent of total Region	-	69.8%	-	65.0%	-4.8pts
• Employment as per cent of population	-	58.0%	-	60.0%	2.0pts
• Labour Force	-	1,207,630	-	1,275,365	5.6%
• Regional Share	-	63.7%	-	59.4%	-4.3pts
Durham Region					
• Population	214,736	283,639	32.1%	326,179	15.0%
• Growth (1971-1986)	-	-	-	111,443	-
• Share of GTA population	7.4%	8.3%	0.9pts	8.7%	0.4pts
• Employment	-	103,160	-	*117,000	13.4%
• Employment as per cent of total Region	-	5.8%	-	5.8%	0.0pts
• Employment as per cent of population	-	36.3%	-	35.9%	-0.4pts
• Labour Force	-	144,220	-	176,680	22.5%
• Regional Share	-	7.6%	-	8.2%	0.6pts
York Region					
• Population	166,060	252,053	51.8%	350,607	39.1%
• Growth (1971-1986)	-	-	-	184,547	-
• Share of GTA population	5.7%	7.4%	1.7pts	9.4%	2.0pts
• Employment	-	105,945	-	170,612	61.0%
• Employment as per cent of total Region	-	6.0%	-	8.4%	2.4pts
• Employment as per cent of population	-	42.0%	-	48.7%	6.7pts
• Labour Force	-	133,010	-	195,010	46.6%
• Regional Share	-	7.0%	-	9.1%	2.1pts
Peel Region					
• Population	259,874	490,731	88.8%	592,169	20.7%
• Growth (1971-1986)	-	-	-	332,295	-
• Share of GTA population	8.9%	14.4%	5.5pts	15.9%	1.5pts
• Employment	-	227,086	-	301,813	32.9%
• Employment as per cent of total Region	-	12.8%	-	14.9%	2.1pts
• Employment as per cent of population	-	46.2%	-	51.0%	4.8pts
• Labour Force	-	272,775	-	346,455	27.0%
• Regional Share	-	14.4%	-	16.1%	1.7pts
Halton Region					
• Population	189,851	253,883	33.7%	271,389	6.9%
• Growth (1971-1986)	-	-	-	81,538	-
• Share of GTA population	6.5%	7.4%	0.9pts	7.3%	-0.1pts
• Employment	-	99,755	-	*110,000	10.3%
• Employment as per cent of total Region	-	5.6%	-	5.4%	-0.2pts
• Employment as per cent of population	-	39.3%	-	40.5%	1.2pts
• Labour Force	-	136,915	-	154,215	12.6%
• Regional Share	-	7.2%	-	7.2%	0.0pts
Greater Toronto Area					
• Population	2,920,250	3,417,701	17.0%	3,733,065	9.2%
• Growth (1971-1986)	-	-	-	812,815	-
• Share of GTA population	100.0%	100.0%	-	100.0%	-
• Employment	-	1,775,946	-	2,019,425	13.7%
• Employment as per cent of total Region	-	100.0%	-	100.0%	-
• Employment as per cent of population	-	52.0%	-	54.1%	2.1pts
• Labour Force	-	1,894,550	-	2,147,725	13.4%
• Regional Share	-	100.0%	-	100.0%	

Note: * = Estimate

Sources: Metropolitan Toronto Planning Department. Projections and Their Policy Implications. (April, 1989) Table P.1.

Metropolitan Toronto Planning Department. Metropolitan Plan Review: Metropolitan Roads. (August, 1989) Tables 1 and 2.

The Primary Study Area

Population within this Study Area has been stable since 1981. According to a recent study completed by the City of North York Planning Department[3], the Clanton Park and Bathurst Manor communities, which, together, coincide with much of the Primary Study Area for this assessment, contains a high proportion of seniors (roughly 20%) compared to a 9.7% rate for North York as a whole. This group would gain particular benefit from proximity to public transit.

3.2.2 Employment and Labour Force Patterns

The GTA

As Table 3.2.1 illustrates, Metropolitan Toronto's share of the GTA's population fell from 62.5% to 58.7% between 1981 and 1986, as did its share of employment, which dropped from 69.8% to 65.0% over this same period. These losses in share were offset by corresponding gains in both population and employment by Peel and York Regions.

Nevertheless, **Metropolitan Toronto's generation of employment opportunities per unit of population, at 60%, is still significantly higher than for any of the other regional municipalities,** highlighting its continuing role as a focus of employment for its residents and residents of the surrounding areas. A recent review by the Metropolitan Toronto Planning Department of employment trends concludes that:

> "Metro is undergoing greater employment growth than the [Official] Plan projected and will greatly surpass the 2001 projection of 1,400,000 jobs...the Central Area is growing faster than expected, accounting for 31% of Metro's employment growth and surpassing the 52,000 forecast for the period 1976-2001...Changes in travel patterns are resulting in increases in commuting from the regions surrounding Metro..."[4]

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[3] City of North York. Sheppard West Study: Background Report and Secondary Plan Alternatives. Long-Range Planning Division, 1987.

[4] Municipality of Metropolitan Toronto. Metropolitan Plan Review: Centres & Office Areas. Report No. 9 (1989), pp. 35-36 & 46.

Labour force statistics available for 1986 indicate that, while Metropolitan Toronto's employment opportunities exceed its resident labour force, the opposite is true for all other Regional Municipalities. Indeed, in 1986, while Metropolitan Toronto's employment opportunities exceeded its resident labour force by some 44,600, employment in the non-Metro Regional Municipalities fell short of their resident labour forces by over 170,000. This distribution reflects the inflow to Metro of workers from surrounding areas.

As the policy-related section of this assessment (Section 3.3) indicates, Metropolitan Toronto's strategy (since 1981) of encouraging development of higher density, mixed-use "centres"[5] within Metro but outside of the Central Area, has been largely successful.

A recent Metro Plan Review document[6] notes the following:

> "A review of office development indicates that Centres outside the Central Area have more than doubled their amount of office space...What becomes apparent is that most of the Centres are meeting the employment targets in the Plan having undergone a growth of 40,000 jobs since 1976...**the unexpectedly large increases in employment growth in Metro Toronto have not only been in the Central Area...but more significantly in dispersed locations in the rest of Metro which have had a growth of 95,000 jobs.**"

While it was originally intended that employment growth go to centres served by rapid transit, the Metro Plan Review finds that of non-Central Area employment growth, 61% is not rapid-transit oriented and that nearly two-thirds of proposed office space is in auto-oriented locations[7].

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[5] "Major" centres designated in the MetroPlan include Scarborough and North York City centres. "Intermediate" centres identified include Islington/Kipling, St. Clair/Yonge Street, Eglinton/Yonge Street and Kennedy/Eglinton Avenue.

[6] Municipality of Metropolitan Toronto. Metropolitan Plan Review: Centres & Office Areas. (1989) p. 38

[7] Ibid p. 39.

Increases in employment opportunities within **York and Peel Regions** have also been substantial in both absolute and percentage growth terms. As Table 3.2.1 indicates, employment in York Region rose by roughly 65,000 over the five-year period (1981-1986) and at a much higher rate than that of population growth. Peel Region employment totals grew by almost 75,000 over the same period, along with it's overall share of GTA employment (from 12.8% up to 14.9%).

Within the Metropolitan Toronto context, North York's major growth in retail and service commercial employment took place in the following decade, with increases of over 100% being achieved (27,715 in 1971 up to 56,094 in 1981)[8]. The North York "Centre" which follows a linear shape along Yonge Street between Sheppard and Finch Avenues and which is along the main north-south subway line, is the most successful example of transit-oriented "centre" development outside the Central Area of Metro. By 1988, it was reported to have a total of 22,800 employment, 78% of which was office-related.[9]

Growth in employment to reach the North York Secondary Plan for the City Centre target of 51,000, however, will require major improvements to the transportation system in the view of Metropolitan Toronto, its member municipalities and the Province of Ontario.

In summary, employment and labour force figures for Municipalities within the GTA point to an increase in work-related trips by a rapidly increasing labour force living outside of, but working within, Metropolitan Toronto, which remains a major source of employment.

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[8] City of North York. Retail and Service Commercial Policy Study. Long-Range Planning Division (1987) p.27.

[9] Metropolitan Toronto. Metropolitan Plan Review: Centres & Office Areas. Report No. 9 (1989) pp. 52-53.

3.3 Planning and Policy Context

3.3.1 Provincial Policy

In 1988, Ontario's Ministry of Transportation issued a policy statement setting out the government's recommended course for transportation investment (roads and transit) in the Greater Toronto Area (GTA).[10] The statement, among others, notes that "jurisdictional boundaries must be overcome to allow the free flow of people using transit services throughout the G.T.A." (p.7) It also lists a number of provincial principles regarding transportation (p.4), namely, those of:

- ensuring that transportation services support the desired form of urban development throughout the G.T.A.;
- responding to the growth occurring in downtown Toronto, but actively promoting development in the city centres and emerging sub-centres;
- addressing congestion and obtaining maximum use of existing facilities;
- ensuring transportation planning is done in a full regional context with due consideration for affordability and fair distribution of benefits;
- balancing investment between roads and transit to address both commercial and personal travel needs;
- protecting options and retaining the flexibility to respond to change.

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[10] Ontario Ministry of Transportation. Transportation Directions for the Greater Toronto Area. (May, 1988)

As part of the policy statement, the Ministry provided direction with respect to its priorities for future transit extensions, including an extension of the Spadina Subway.

In April, 1990, Ontario's Minister of Transportation announced "the province's commitment to a continuous program of rapid transit development in the Greater Toronto Area (GTA) for the 1990's" involving a $5 billion infrastructure investment in the transportation system[11]. The first of the eight priorities listed for funding is to accomplish the following:

> "Loop the Yonge and Spadina subway lines into a single system in the Finch-Steeles area...A major component of our transit agenda is the Yonge-Spadina subway loop recommended by the North Metro Boundary Transportation Review. We consider this an essential element for moving people across the North Metro-York boundary;"[12]

The proposed Undertaking, which would extend the Spadina line northward towards the Finch-Steeles area, represents an essential part of this recently announced, high priority provincial policy initiative.

3.3.2 Metropolitan Toronto Policy

The Official Plan for the Municipality of Metropolitan Toronto, adopted in 1981, recommended that in response to increasing congestion in the downtown area, Metro Toronto should move away from its central core orientation to a multi-centred urban structure, and that to this end, the evolution of "Metropolitan Centres" should be encouraged along rapid transit facilities to facilitate two-way use of the subway system:

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[11] News Release, Ministry of Transportation of Ontario. Let's Move: Transportation Solutions for the 90s. (April 5, 1990)

[12] Remarks by the Honourable William Wrye, Minister of Transportation. Let's Move: Transportation Solutions for the 90's. (Union Station, Toronto, April 5, 1990) p.3-4.

> "A fundamental aim of the Plan is to create a multi-centred urban structure. This can be achieved through the development of Metropolitan Centres located along rapid transit facilities.[13]"

Areas within North York and Scarborough were identified as intended "Major Centres" which would become "focal points of business, government and community activity.[14]" It was also seen as desirable that development of centres in regions surrounding Metro occur to relieve pressure on Metro's transportation system[15]. The Metropolitan transportation system should, the Plan also noted, "emphasize transit and arterial road accessibility to each designated centre, both from the surrounding district and from the Planning Area as a whole.[16]"

The Plan states that:

> "The construction of future rapid transit facilities to improve general mobility and support the centres shall be determined as a result of monitoring growth and change in travel patterns." (Section 3 G [2])

The on-going review of Metro Toronto's Official Plan, initiated in March 1986, resulted in the recommendation in 1989 that Council's top priority for expansion of the Metropolitan rapid transit system remain the Sheppard Subway and that Metropolitan Toronto would support the early extension of the Spadina Subway to Sheppard Avenue (the Undertaking).

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[13] "Centre" is defined in MetroPlan as "an area designated by Council along a rapid transit line for the concentration and mixed development of business, government, housing, institutions and cultural and recreational facilities. (Section 1 D. [6])

[14] Municipality of Metropolitan Toronto. Official Plan for the Urban Structure. (1981) Section 3 C. [4] and Section 4 C [2].

[15] Municipality of Metropolitan Toronto. Metropolitan Plan Review: Centres & Office Areas. Report No. 9 (1989) p.9

[16] Metropolitan Toronto. Official Plan for the Urban Structure. (1981), Section 6, B3.

It is also relevant to note that Metropolitan Toronto's Official Plan designated the Downsview Airport lands, which are within the Primary Study Area for the proposed Undertaking, as the "Downsview Special Study Area":

> "as an interim policy, any new development permitted should be of a scale and type which will not adversely prejudice future options for development of the site at a scale of significance to the Metropolitan urban structure."

Metropolitan Toronto's Northwest Metro Transportation Study[17] noted that:

> "the Downsview airport site remains a tremendous opportunity for a second major centre in North York. Recognizing the need for, and desirability of increased population within Metropolitan Toronto, any development plan for this area should give high priority to the provision of significant amounts of new housing."

Immediately following and in response to the announcement by the Province in April, 1990 of its Let's Move initiative and its $5 billion investment in rapid transit expansion for the 1990's, Metropolitan Toronto, jointly with the TTC, published the Let's Do It: Response and Implementation Strategy containing, among others, the recommendation that the Commission and Metro Council endorse the rapid transit plan contained in the provincial "Let's Move" announcement:

> "Since the proposed initiatives are consistent with Metropolitan and TTC objectives and plans, the TTC and Metropolitan Toronto should accept, in its entirety, the 10-year rapid transit plan...Metro and TTC staff acknowledge that the Loop is an attractive option to address the growing inter-regional travel problem.[18]"

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[17] Municipality of Metropolitan Toronto.Northwest Metro Transportation Study. (March 1988) p. xiii.

[18] Toronto Transit Commission and Municipality of Metropolitan Toronto. Let's Move: A Rapid Transit Agenda for the 1990's - Let's Do It: A Joint TTC/Metropolitan Toronto Response and Implementation Strategy. (April, 1990) p. 4 and p.13.

City of North York Policy

North York's Official Plan, consolidated to September, 1988, affirms the Metropolitan Toronto Official Plan objective of creating a major centre for North York and introducing rapid transit along Sheppard Avenue:

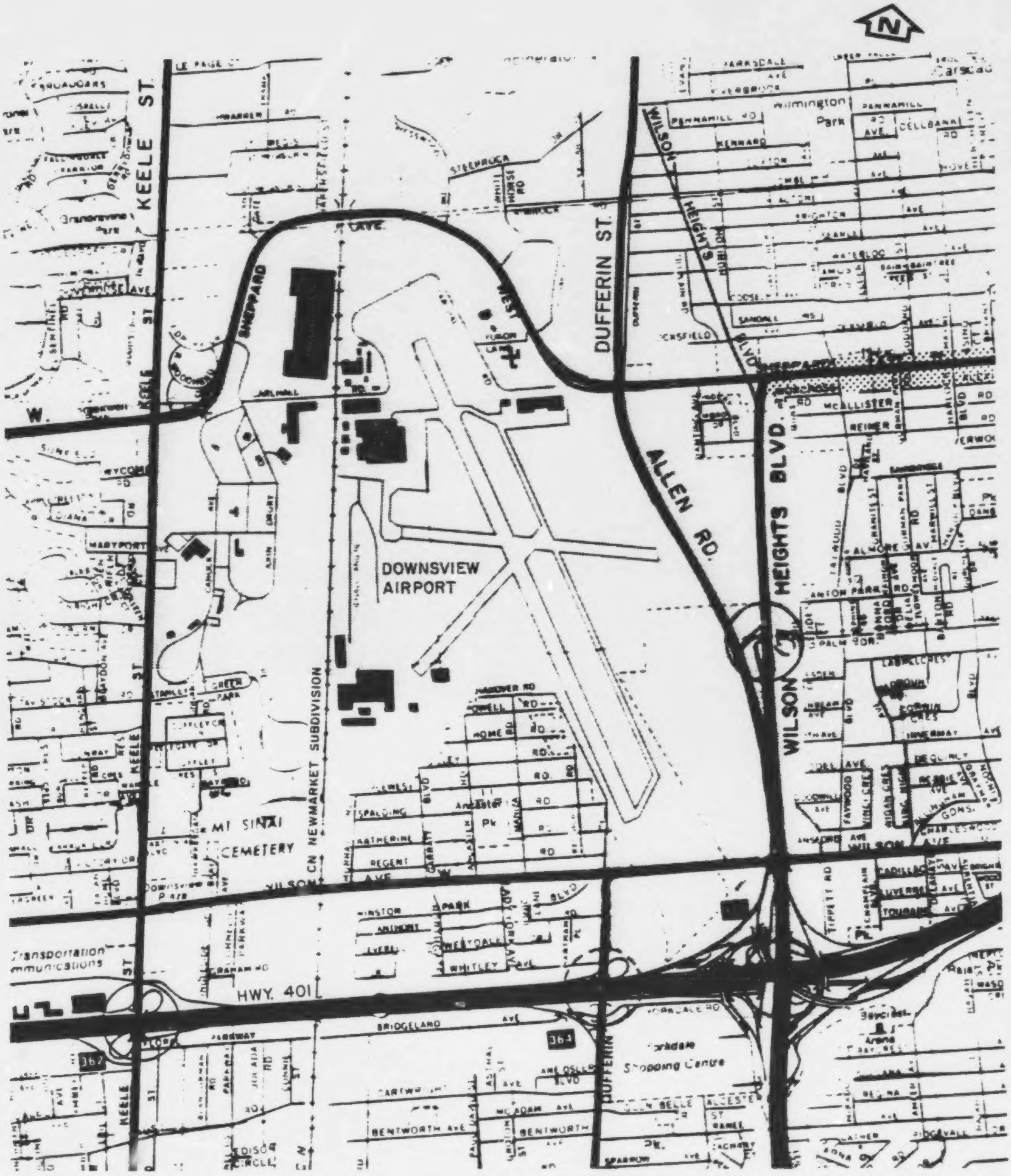
> "Pursuant to its objective of developing the Yonge Street Centre Area as the central focal point of the city, Council shall endeavour to promote in addition to the present north/south transit system along Yonge Street, the establishment of an east/west rapid transit system through this area." (Section 9.2.0)

North York's Official Plan like Metro's, specifies that should the Downsview Airport Lands become available for development, future land uses are to be determined through a special study, prior to amendment of the Plan. In order to ensure the safety of flights in and out of the Base, the City of North York Bylaw 19398 places height limitations on buildings.

3.4 Transportation

3.4.1 Roads

Exhibit 3.4.1 highlights the road system existing in the Primary Study Area. The dominating feature of the system is the combination of the northern extremity of the William R. Allen Expressway and Allen Road which together form the major north-south arterial route. Approximately 2km west of Allen Road, the next major north-south arterial is Keele Street, while immediately east of the Allen Road corridor, Wilson Heights Boulevard provides a third major north-south route through the study area. Both Allen Road and Keele Street provide direct access to and from Highway 401, which runs east-west immediately south of Wilson Station. East-west through traffic is carried on Highway 401 and all remaining traffic on two arterials, approximately 2km apart, i.e., Wilson Avenue along the southern limit of the area and Sheppard Avenue across the northern portion.


N
KEELE ST.
DUFFERIN ST.
WILSON HEIGHTS BLVD.
ALLEN RD.
SHEPPARD
W.
DOWNSVIEW AIRPORT
CN NEWMARKET SUBDIVISION
MT SINAI CEMETERY
WILSON AVE
HWY. 401
Wilmington Park
Yorkdale Shopping Centre
BENTWORTH AVE
BRIDGELAND AVE
CARTWRIGHT
MCADAM AVE
DOWNSVIEW PARK
CARSCADDEN
LE PAGE CT
MARYPORT AVE
364
367

PRIMARY STUDY AREA

MAJOR ARTERIAL ROADS ━

PROVINCIAL FREEWAY ▬

ROAD SYSTEM IN PRIMARY STUDY AREA

EXHIBIT 3.4.1.

In the Metropolitan Toronto Official Plan, the designated rights-of-way for these arterials are:

Allen Road	45 m minimum
Keele Street	30-36 m
Wilson Avenue	30-36 m
Sheppard Avenue	30 m

At present, Allen Road contains six traffic lanes, two of which are reserved for buses during a.m. and p.m. peak periods on weekdays. Keele Street, Wilson Avenue and Sheppard Avenue are presently four-lane roads with left turn lanes at major intersections. The only grade-separated intersection in the study area is on Wilson Avenue where it passes under Allen Road.

Metro Transportation Department has investigated the operating conditions at the major intersections in the study area as part of the Northwest Metro Transportation Study.[19] Many of the arterial road links and intersections were found to be operating at or near capacity. The investigation concluded that in 1988 the intersection of Sheppard Avenue and Allen Road was operating at more than 90 per cent of capacity. Similar results were found for intersections along Steeles Avenue and Bathurst Street. The current congestion levels are shown graphically in Exhibit 3.4.2. Measures to restrict commuter access to local streets during peak hours are already in place in areas south of Steeles Avenue. The study also noted that the growth in traffic volume in the northwest area of the city, and especially between York Region and the secondary study area, is reducing the average operating speed of both cars and transit vehicles. Average auto speeds on Steeles Avenue have reduced by more than 5km/hour over the 1978-1986 period.

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[19] Metropolitan Toronto Planning Department. Northwest Metro Transportation Study (March, 1988).

3.4.2 Transit

The focus of surface transit routes in the primary study area is provision of feeder service to the present terminal of the Spadina Subway Line - Wilson Station at the intersection of Wilson Avenue and the Allen Expressway. Presently, all routes are operated with 60 passenger standard buses. Transit service comprises:

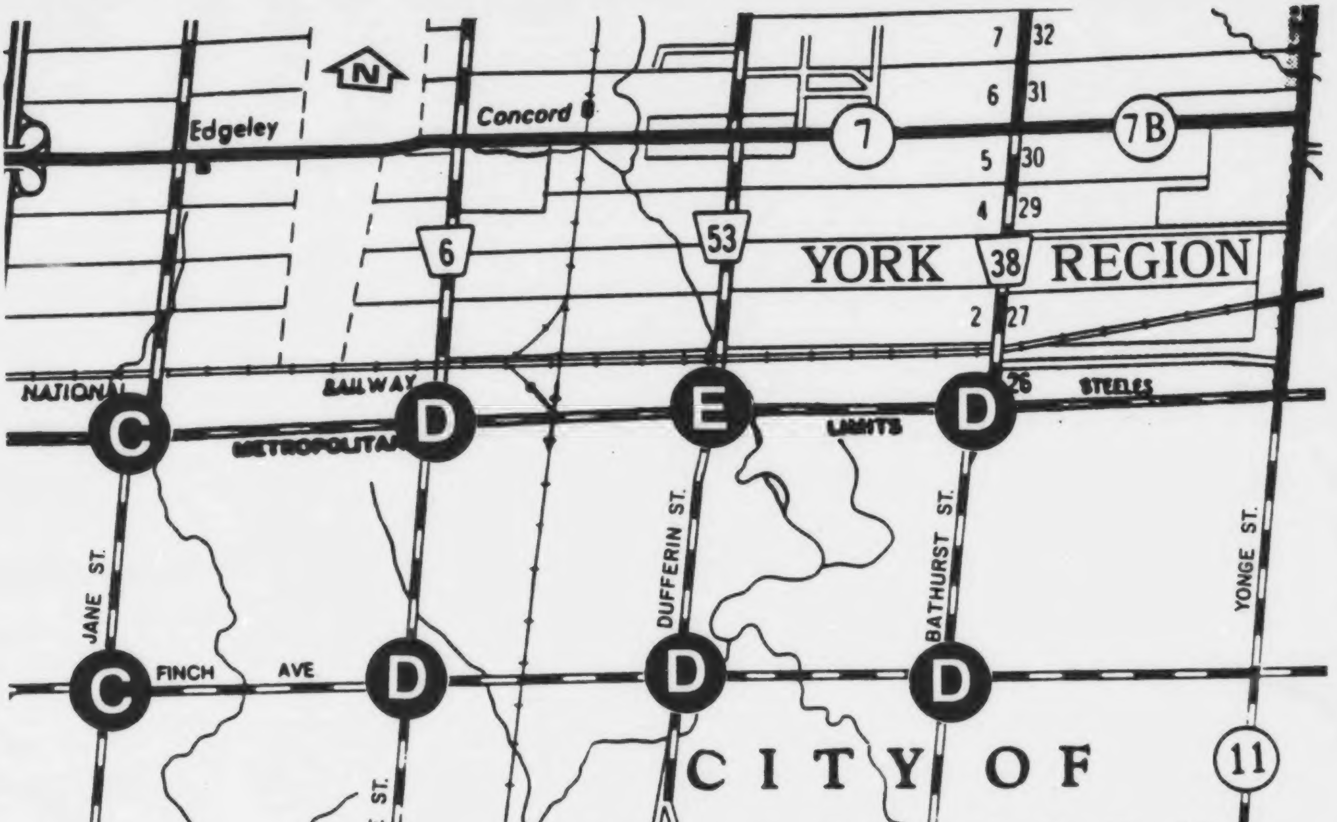
- Downsview (108), York University (106), Grandravine (119) and Keele North (107) routes from the north west travelling east-west along Sheppard Avenue and north-south on Allen Road. These routes combine to an average peak-hour headway of 1.5 minutes on Allen Road and presently carry approximately 2300 passengers during the a.m. peak-hour in the peak-direction to Wilson Station.

- Alness (117) and Finch via Allen (118) routes from the north, operating north-south on Dufferin Street and Allen Road at five and twelve minute headways respectively and carrying approximately 750 a.m. peak-hour/peak-direction passengers.

- Wilson Heights (105) and Faywood (104) local routes serving communities east of Allen Road and Dufferin Streets and accessing Wilson Station from Wilson Heights and Faywood Boulevards at twelve and nine minute headways, respectively.

- Wilson (96), Dufferin (29), Bathurst (7), Ancaster Park (3) and Calvington (120) routes travelling east-west along Wilson Avenue into Wilson Station at headways between two and twenty minutes.

Other routes, part of the TTC's grid network passing through the study area include the Sheppard West (84) and Finch West (36) services, running east-west on Sheppard and Finch Avenues. The Sheppard West (84) service operates on a.m. peak headways of 3.5 minutes and carries approximately 500 a.m. peak-hour, peak-direction passengers into Sheppard Station. The Finch West (36) route provides 2.7 minutes headway, at a.m. peak service, carrying approximately 1,065 passengers into Finch Station during the peak hour.

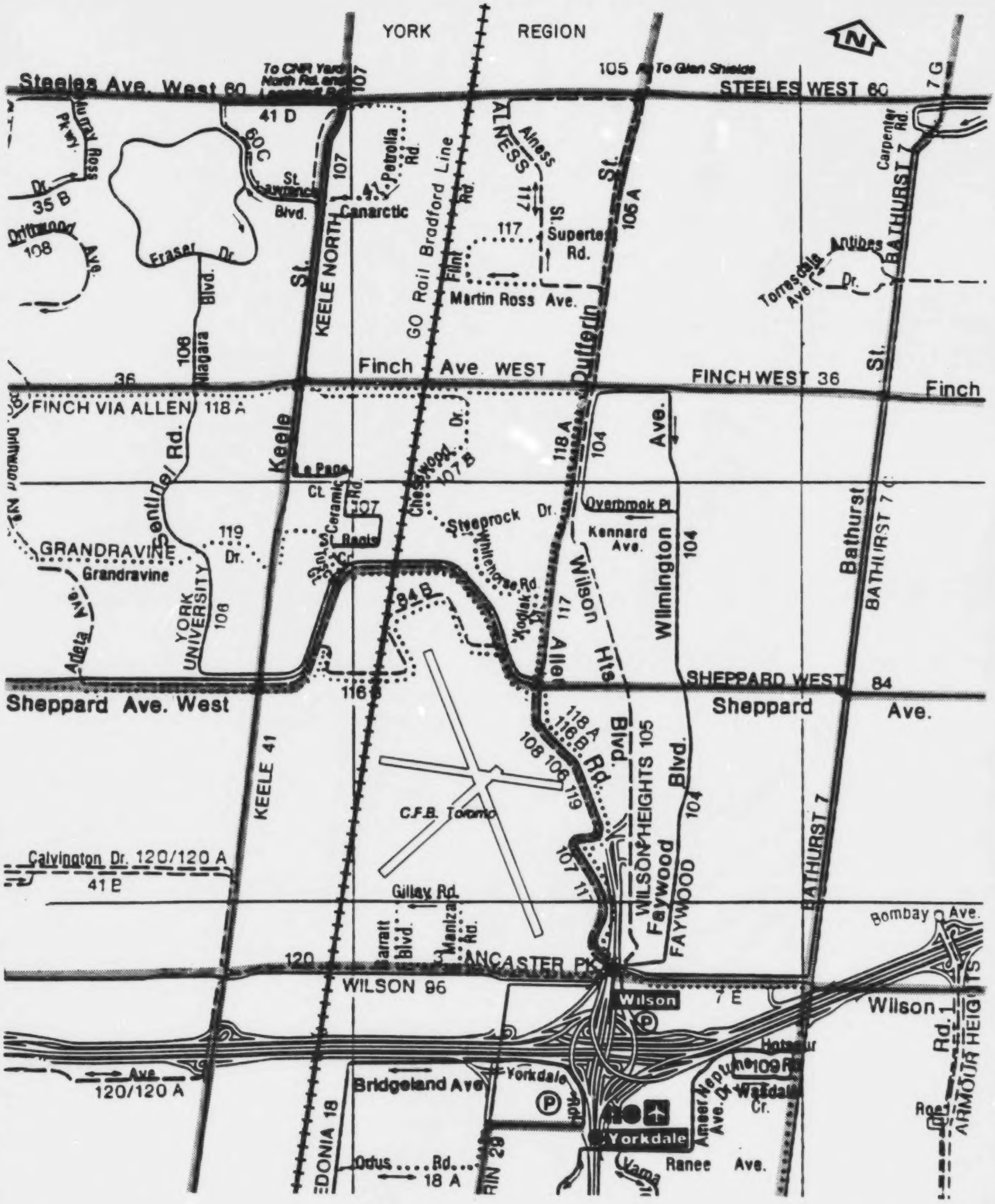

N
Edgeley
Concord
7
7B
6
53
38
YORK REGION
32
31
30
29
27
26
7
6
5
4
2
NATIONAL RAILWAY
METROPOLITAN LIMITS
STEELES
JANE ST.
KEELE ST.
DUFFERIN ST.
BATHURST ST.
YONGE ST.
FINCH AVE
SHEPPARD AVE
CITY OF NORTH YORK
11
ALLEN RD.
DOWNSVIEW AIRPORT
Don
WILSON
CARTIER
FREEWAY
401
50
50A
51
52
53
RD
C
D
E
D
C
D
D
D
B
E
E
D
D
D
D
C

LEGEND

Level of Service	Volume/Capacity	
A	≤ 0.6	Free Flow
B	≤ 0.7	Stable Flow (slight decline in level of freedom)
C	≤ 0.8	Stable Flow (moderate decline in level of freedom)
D	≤ 0.9	High Density Stable Flow
E	≤ 1.0	Road at or Near Capacity
F	≤ 1.0	Road above Theoretical Capacity

LEVEL OF SERVICE OF INTERSECTIONS IN SECONDARY STUDY AREA

EXHIBIT 3.4.2


YORK REGION
N
Steeles Ave. West 60
To CNR Yards North Rd. and Langstaff Rd.
107
105 To Glen Shields
STEELES WEST 60
7 G
41 D
Murray Ross Pkwy.
Dr.
35 B
Driftwood
108
Ave.
60 C
St. Lawrence Blvd.
47 Petrolia Rd.
Canarctic
Fraser Dr.
Blvd.
Niagara
108
St.
KEELE NORTH 107
GO Rail Bradford Line
Flint Rd.
ALNESS
Alness
117
St.
117
Supertest Rd.
Dufferin St.
105 A
Martin Ross Ave.
Carpenter Rd.
BATHURST 7
Antibes
Torresdale Ave.
Dr.
St.
Finch Ave. WEST
36
FINCH WEST 36
Finch
FINCH VIA ALLEN 118 A
Driftwood Ct.
Sentinel Rd.
Keele
Le Page Ct.
Ceramic Rd.
107
Chesswood Dr.
107 B
118 A
104
Ave.
Overbrook Pl.
Steeprock Dr.
Kennard Ave.
Wilmington
104
Bathurst
BATHURST 7
GRANDRAVINE
119
Dr.
Grandravine
St. Regis Cr.
Whitehorse Rd.
Wilson Hts
YORK UNIVERSITY 106
Arleta Ave.
84 B
Kodiak
117
Allen
36
116 B
Sheppard Ave. West
SHEPPARD WEST 84
Sheppard Ave.
118 A
116 B
108 106
Rd.
Blvd.
119
WILSON HEIGHTS 105
Blvd.
104
KEELE 41
C.F.B. Toronto
Calvington Dr. 120/120 A
41 B
107 11
Faywood
FAYWOOD
BATHURST 7
Gilley Rd.
Barratt Blvd.
Maniza Rd.
Bombay Ave.
120
LANCASTER PK
WILSON 96
Wilson
7 E
Wilson
Rd. 1
ARMOUR HEIGHTS
Ave.
120/120 A
Bridgeland Ave.
Yorkdale
Rd.
Hotspur
109 Rd.
Ameer Ave.
Neptune Dr.
Wasdale Cr.
Roe
Yorkdale
CALEDONIA 18
DUFFERIN 29
Ranee Ave.
Yama
Otis Rd.
18 A

REGULAR SURFACE ROUTES — FINCH WEST 36

RUSH HOUR SURFACE ROUTES — GRANDRAVINE 119

LIMITED SERVICE SURFACE ROUTES — ALNESS 117

TRANSIT ROUTES IN THE PRIMARY STUDY AREA

EXHIBIT 3.4.3.

Through regular service monitoring and adjustment, the TTC has matched the level of service closely with demand according to vehicle loading standards. However, some additional capacity is available on some of the lower demand routes such as the Calvington (120), Ancaster Park (3), Faywood (104) and Grandravine (119).

The Spadina subway line presently terminates at the south limit of the study area, i.e., at Wilson Station, where a major bus-subway transfer terminal, a passenger pick-up and drop-off carousel and a 2,000 car park-and-ride facility are provided. At present, subway service to Wilson Station operates at approximately 4.5 minute headways since alternate trains are turned back further south at St. Clair West station thus doubling the 135 second scheduled headway on the remainder of the Yonge-University-Spadina subway line.

The 1989 a.m. peak hour ridership on the Spadina subway between Wilson Station and St. George Station (the interchange with the Bloor subway line) averaged 12,000 passengers per hour per direction (pphpd). Under the present service frequency, the capacity of the service north of St. Clair West Station is 17,000 pphpd on six-car trains with a loading standard of 1,200 passengers per train.

3.4.3 Commuter Rail

GO Transit operates one commuter train in each a.m. and p.m. peak hour on Canadian National's Newmarket Subdivision tracks which run north-south through the study area approximately 1km west of Allen Road. However this service does not provide direct access to the area as there are no stations within the immediate vicinity, the nearest being at Maple, 12 km north of Sheppard Avenue. The CN Newmarket Subdivision has a 20-25m right-of-way through the area. Freight traffic on this subdivision and the limited right-of-way width have precluded implementation of a station stop south of Maple.

3.5 Land Use and Development

3.5.1 Existing Land Uses

As Exhibit 3.5.1 shows graphically, land use within the Primary Study Area is diverse, encompassing residential, commercial, industrial, institutional and air, road and subway transportation components. The Downsview airport lands are particularly prominent.

Residential uses are largely single family, with pockets of medium density development, the latter being found primarily at the Sheppard Avenue/Wilmington Street intersection. While some of the housing stock dates back to the 1920-1945 period, the majority was constructed in the early post-war years (1945-1955). The Balmoral subdivision, located east of Wilson Heights and south of Sheppard Avenue is the newest addition to the area, with a number of homes having been completed and occupied.

A detailed study undertaken by the North York Long-Range Planning Division[20] provides a characterization of land use trends for a corridor running along Sheppard Avenue east of Allen Road:

> "Generally, it may be said that the interior-facing residential properties are distinct, and there are no apparent pressures for redevelopment of these lands. However, interest has been and continues to be shown for redevelopment of existing Sheppard-fronting properties to commercial, institutional and multiple-family residential land uses...this development pressure seems to parallel the findings relating to owner occupancy, where there is a significant amount of tenant-occupied dwellings on Sheppard Avenue - all indicative of a less than stable residential neighbourhood." (p. 8)

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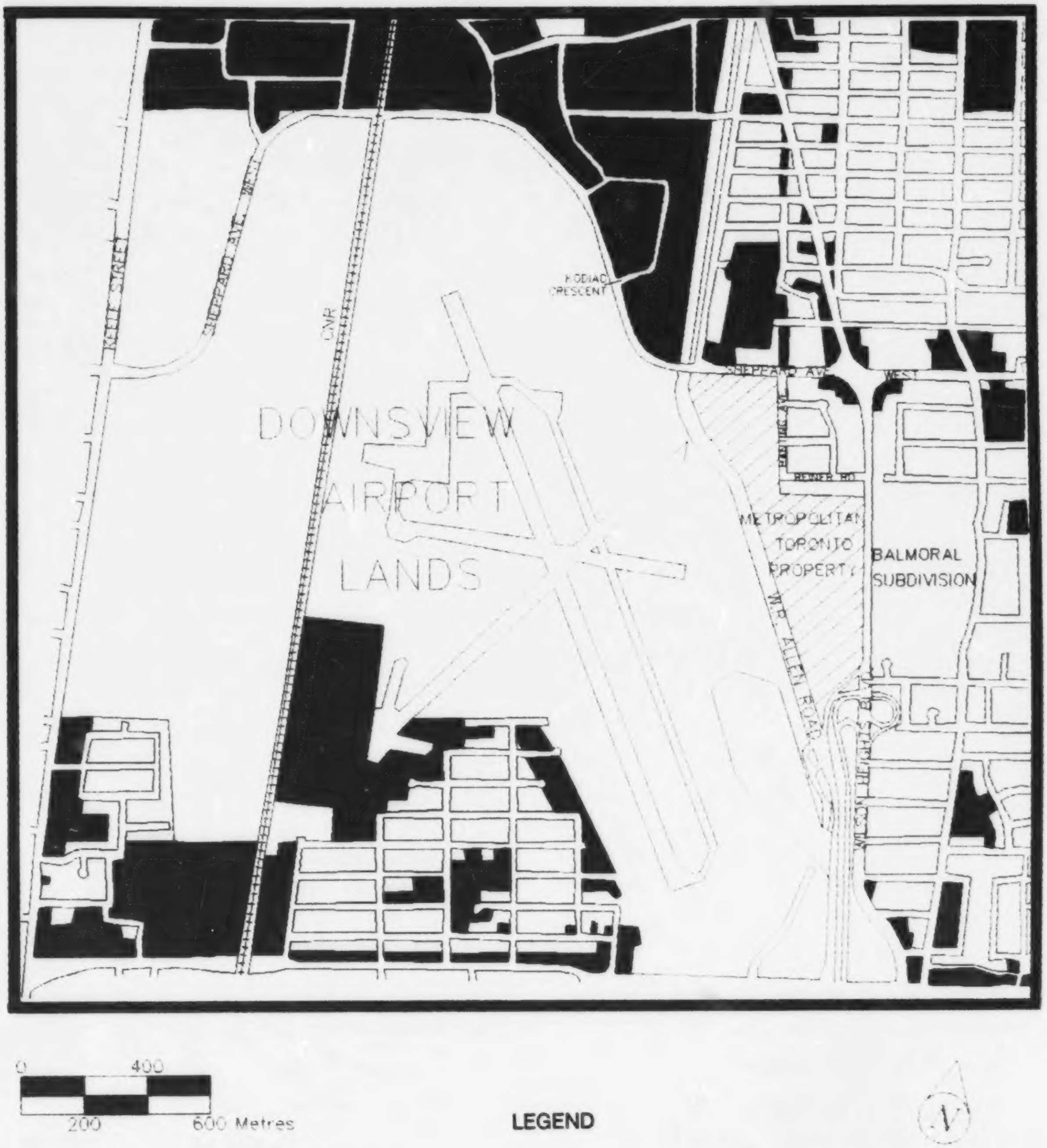
[20] North York Long-Range Planning Division. Sheppard West Study Background Report and Secondary Plan Alternatives. (November, 1987)


KEELE STREET
SHEPPARD AVE. WEST
CNR
DOWNSVIEW
AIRPORT
LANDS
KODIAC CRESCENT
SHEPPARD AVE WEST
REINER RD
METROPOLITAN TORONTO PROPERTY
BALMORAL SUBDIVISION
W.R. ALLEN ROAD
WILSON HEIGHTS BLVD
0
400
200
600 Metres
N

LEGEND

☐ RESIDENTIAL LOW DENSITY
■ RESIDENTIAL MEDIUM DENSITY
■ RESIDENTIAL HIGH DENSITY
■ COMMERCIAL
■ INDUSTRIAL
■ INSTITUTIONAL
☐ TRANSPORTATION
■ OPEN SPACE

LANDUSES IN THE PRIMARY STUDY AREA

EXHIBIT 3.5.1.

The Sheppard West study also provides information regarding tenure:

> "...This would tend to suggest a higher population turnover rate within the area, due to tenants moving out and new tenants moving in, and therefore, a somewhat less stable neighbourhood setting.
>
> Further, it provides some evidence of speculation on this portion of Sheppard Avenue.... possibly a result of impending plans for a Sheppard subway line, and/or a result of the current pattern of development being observed i.e., away from single-family residential development to commercial, institutional and higher density residential development." (p. 7)

Commercial/Industrial development, for the most part, abuts Sheppard Avenue and Dufferin Street. On the north side of the Sheppard/Wilmington intersection, there is mixed residential/commercial development, with a number of single-family dwellings zoned as commercial. Moving westward to the Sheppard Avenue/Wilson Heights intersection, all four corners are commercial. Between Wilmington Street and Wilson Heights Blvd., a number of vacant lots are the subject of rezoning application for commercial/office uses.

The northeast corner of the Allen Road/Sheppard Avenue intersection is privately owned and developed as a used car dealership. Abutting properties, although currently residential, are zoned to allow future commercial uses.

The northwest corner of the Allen Road/Sheppard Avenue intersection is vacant, and privately owned property. Designated in the City of North York Official Plan as Commercial and zoned Industrial-Commercial, the property has received site plan approval for retail/industrial warehouse uses.

Property on **the southeast corner of the Allen Road/Sheppard Avenue intersection** was sold by the Federal government to Metropolitan Toronto in May, 1986. A year later, it was recommended that the Commission:

> "approve protection of the entire property at Allen Road and Sheppard Avenue for future transit use..."
>
> "inform the private development industry and Metro Council of the Commission's long term intent with respect to the above lands."

This recommendation was accepted. The City of North York Official Plan designation for the property at present is Industrial and its zoning is Airport.

A large industrial park has been developed along the north side of Sheppard Avenue, west of Dufferin Street and extends over to Keele Street. This same park extends northward to Steeles Avenue.

Institutional uses depicted on Exhibit 3.5.1 are primarily schools and places of worship, which are dispersed throughout the Study Area.

3.5.2 Additional Land Use Factors

Downsview Airport Lands

The Department of National Defence (DND) has indicated that:

> "the airfield...will remain in operation for the foreseeable future. All other vacant lands must be reserved for long-term development by this Department. Thus, above-ground construction within the existing perimeter will not be permitted...[21]"

In the southwest corner of the Base, however, some residential redevelopment of airfield lands is being planned by Canada Mortgage and Housing (CMHC). The Federal proposal calls for provision of some 5,000 residential units on approximately 55 hectares. In view of the fact that both Metropolitan Toronto and North York have assigned a "special study area" status to the Base lands, the potential for its development beyond the "foreseeable future" remains a possibility which would have significant potential for residential, commercial and industrial growth within the secondary study area.

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[21] Department of National Defence Correspondence to Mr. L. Erskine of Delcan Corporation, dated 17 November, 1989.

Infrastructural Factors

Properties on the north side of Sheppard Avenue drain to the White Horse sanitary sewer sub-trunk which connects with Metropolitan Toronto's West Don system trunk sewer. Properties on the south side drain to the Sheppard Avenue Sub-trunk which also connects with the West Don system trunk. Both the sub-trunk and Metro Don system trunk sewers are at capacity, with basement flooding occurring on rainy days along Sheppard Avenue, as a result of infiltration into the sanitary system.

The primary problem with capacity is with the West Don Sanitary Sewer Trunk system. In this regard, the Metro Works Department has determined that there is sufficient capacity in the West Don Trunk to accommodate, across the entire watershed, an equivalent population of 82,000 beyond the population permitted by the zoning existing in 1976.

Since that year, rezoning throughout the watershed has consumed roughly 40% of that capacity and the remaining capacity has been absorbed by development permitted in the Official Plan for the Downtown, Uptown (south of Finch), York Mills Office Centre, surplus Downsview Airport Lands and Sheppard Commercial Area to the west of Yonge Street.

Currently, Metropolitan Toronto is undertaking an environmental assessment to address the upgrading of the system in the Don River Watershed. In the mean time, large or major rezoning applications fo development are encountering capacity limitations in the local and Metropolitan sewer systems. it is estimated that roughly $800 million will be required to complete the upgrading.

3.6 Natural Environment

3.6.1 Physiography

The entire study area is located in the physiographic region known as the Peel Plain. The gentle inclination of the land and the fertile clay soils attracted numerous settlers in the early nineteenth century and the area gained a considerable reputation in agricultural production. With the expansion of the airfield and the end of World War II, farming virtually disappeared and the land is now devoted to residential, industrial, commercial and transportation development.

Chapman and Putnam (1973)[22] have described this landscape as :

> "a level-to-undulating tract of clay soils spanning approximately 493 square km. across the central portions of York, Peel and Halton Regions. The general elevation is from 150 to 230 m above sea level. The topography possesses a gradual and fairly uniform slope toward Lake Ontario. The Credit, Humber, Don and Rouge Rivers have cut deep valleys across this plain, as have other streams such as Bronte, Oakville and Etobicoke Creeks. There are no large undrained depressions, swamps or bogs in the whole area, although in many of the in-stream areas drainage is still imperfect."

3.6.2 Soils

The underlying geological material of the plain has been described by Chapman and Putman (1973):

> "as a till or boulder clay containing large amounts of Palaeozoic shale and limestone. In much of the Peel Plain this has been modified by a veneer of clay which, when deep enough, is clearly seen to be varved. This soil condition is evidence that the landscape was once covered by a glacial lake. The clay is heavy in character and more calcareous than the underlying shaley till, having, presumably, been brought by meltwater from the limestone regions to east and north."

As a result of the moderate gradient of the topography and the uniform consistency of the soils it is expected that construction of a rapid transit extension could be done with ease using conventional construction techniques.

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[22] Chapman, L. and D. Putnam, 1973. The Physiography of Southern Ontario (2nd. edition) University of Toronto Press

A recent study[23] cites the expected occurrence of contaminated soils within the fenced limits of the Metro Works Yard, immediately north of the existing Wilson Yard on Metropolitan Toronto property. The Metro Works Yard is zoned residential (R4) by the City of North York. If the land use were changed to residential or parkland, the site would have to be remediated, most likely by removal and off-site disposal, as elevated levels of lead, oil and grease would make the site unsuitable for future residential or park use.

3.6.3 Vegetation

The landscape in the study area was originally covered by a high quality hardwood forest with a wide diversity of species. As stated earlier, the land was cleared in the early part of the 19th century to allow agriculture to flourish. According to Chapman and Putnam (1973) the better drained parts grew sugar maple, beech, white oak, hickory, basswood and white pine.

The neighbouring valley of Black Creek and the west branch of the Don River supported elm, white ash, white cedar, tamarack, alder swamps and black ash swales. The current mix of trees in the study area is comprised primarily of the sugar maple, manitoba maple, white cedar, willow, ash, lilac and blue spruce.

Trees are generally located in conjunction with residential properties and as remnants of farmstead windbreaks. Disturbed areas in the study corridor support a diversity of primary succession plant life, all of which are comprised of very common species. Only scattered trees exist in the study area, with open, grassed field occupying the majority of the area.

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[23] Dillon Consulting Engineers. Toronto Transit Commission Sheppard Subway Phase 1 Alignment Alternative A2. Subsurface Chemical Analysis and Management Strategy for Excavated Materials. (Toronto, February 1990).

3.6.4 Wildlife

Terrestrial

Wildlife in the study area consists of the small mammals, birds and their habitat within the study area. In discussion with the Ontario Ministry of Natural Resources ([24]Bennett 1990, personal communication), they indicated that only common species (eg. groundhogs, field mice, chipmunks, squirrels, raccoons and skunks) were probable residents in the vicinity of the study corridor. This list is by no means complete but does suggest that the species comprise a fairly common grouping tending toward the "urbanized" assemblages of mammals. Common bird species such as sparrows, robins and crows would be expected to occur. Traffic noise and a lack of suitable habitat, (i.e., no contiguous tracts of forested land or wetland to offer wildlife migration corridors) probably excludes most wildlife from the study area.

There is no special significance attached to the study corridor since :

- there is no record of unusual or rare species; and,
- minimal habitat disturbance would be restricted to open field areas.

Aquatic

Several surface drainage channels drain the Study Area toward the West Don River. However, these are intermittent features which flow during spring thaw or heavy rainfall events. There are no wetlands or areas of aquatic habitat within the Primary Study Area.

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[24] Bennett J. (MNR) 1990 telephone conversation with Myron Humeniuk (Delcan) February 5, 1990.

3.7 Air Quality

3.7.1 Methodology

The specialist firm of Rowan, Williams, Davies & Irwin Inc. (RWDI) was retained to assess existing air quality conditions in the Primary Study Area. This assessment was based on ambient air concentration data from nearby Ministry of the Environment (MOE) monitoring stations. (For information beyond the following summary, see Appendix 3.7 for the final report of RWDI.)

These monitoring stations were brought on line in June of 1988. Data from June to December 1988 were obtained from the MOE by personal communication with the Air Quality Assessment and Instrumentation Unit of the Air Resources Branch and are presented on Tables 3.7.1 and 3.7.2.

3.7.2 Air Quality and Odour Findings

The North York Central monitoring station is located approximately 2.8 km to the northeast of the Sheppard-Allen intersection at Hendon and Yonge Street, near the parking lot for the nearby Yonge subway line.

The North York West monitor is located at 35 Edgar Avenue near the intersection of major Highways 400 and 401 and is approximately 3.5 km to the west of the study site. One important point to note regarding this station is that the monitor is located close to the intersection of a major freeway; thus, data taken here will reflect the much larger number of vehicles contributing to air quality degradation. Based on similar traffic patterns, **air quality at the study site (Sheppard/Allen Rd. intersection) would most likely be best reflected by the data from the North York Central monitoring station.**

When compared with MOE Ambient Air Quality Criteria (Table 3.7.2), there were no exceedances of the sulphur dioxide (SO_2), Carbon Monoxide (CO) or Nitrogen Dioxide (NO_2) criteria during the six month monitoring period. However, the Ozone (O_3) 1-hour criterion was exceeded 154 times at North York Central and 84 times at North York West. The Suspended Particle (size less than 10 microns) SP 24-hour criteria was exceeded 2 times at North York Central and 5 times at North York West.

With the exception of ozone and suspended particles, the air quality over the six month period, June-December 1988, was always within the Ministry's ambient air quality criteria. It should be noted that ozone is a regional problem and is generally not site-specific within an urban area. As expected, the air quality at the monitoring station near the freeway was significantly poorer than at Yonge and Hendon streets for the carbon monoxide and nitrogen oxide gases, because of the much higher level of traffic.

Since traffic patterns at North York Central and the study site are similar, the air quality is expected to be similar. Thus, it is deduced that the existing air quality at the intersection of Sheppard Avenue and Allen Road is quite good at present. Except for suspended particles and ozone, the MOE ambient air quality criteria are not expected to be exceeded at this intersection. Vehicle exhaust emissions due to queuing at the intersection results in the main contribution to air quality reduction.

With respect to odour, personnel at MOE reported that no complaints about odour have been lodged in the area surrounding the proposed Undertaking. However, odour from diesel buses were detectable for a short time, when buses passed by on the Allen Road. The worst-case dispersion event within the residential area would take place during peak traffic periods under calm winds in a stable boundary layer. However, the absence of a complaint history suggests that unpleasant odours were not experienced locally. Air quality impacts due to odours are minimal and do not appear to present a problem for the residential neighbourhoods in the area. Predictions of potential future conditions as a result of a bus concourse and increased bus traffic are discussed in Section 7.0.

3.8 Noise

3.8.1 Guidelines for Noise Impact Assessment

Valcoustics Canada Ltd. was retained to undertake an analysis of existing noise levels in the vicinity of the proposed alignments and new station for the proposed Undertaking. The purpose of these measurements was to quantify the existing sound environment and provide a basis for later assessing potential noise impacts and the need for noise mitigation features as a result of the proposed Undertaking. (Appendix 3.8 contains the full report of findings of Valcoustics Canada Ltd.) As the

TABLE 3.7.1
ONTARIO MINISTRY OF THE ENVIRONMENT DATA ON AIR QUALITY FROM MONITORING STATIONS NEAREST THE SHEPPARD-ALLEN INTERSECTION
JUNE-DECEMBER 1988

North York Central Hendon-Yonge (near car park for subway)				North York West 35 Edgar Avenue (near highways 401 and 400)			
	Peak 1 hr (PPM)	Peak 24 hr[1] (PPM)	Annual Mean (PPM)		Peak 1 hr (PPM)	Peak 24 hr[1] (PPM)	Annual Mean (PPM)
SO_2	0.1	0.04	0.005	SO_2	0.11	0.04	0.009
CO	10.0	6.0	0.8	CO	9.0	6.0	1.2
O_3	0.177	0.073	0.0212	O_3	0.124	0.063	0.0159
NO_2	0.10	0.05	0.019	NO_2	0.14	0.09	0.038
NO	0.43	0.20	0.025	N)	0.53	0.30	0.045
NO_x	0.53	0.25	0.044	NO_x	0.67	0.39	0.083
SP[2]	2.2	1.2	0.34	SP[2]	2.8	1.4	0.20

[1] - For CO the peak is over 8 hours

[2] - Suspended Particles less than 10 microns: units are Coefficient of Haze (COHs) per 100 feet

TABLE 3.7.2
ONTARIO MINISTRY OF THE ENVIRONMENT AIR QUALITY CRITERIA

	1 hr (PPM)	8 hr (PPM)	24 hr (PPM)	Annual Mean (PPM)
SO_2	0.25		0.10	0.02
CO	30.0	13.0		
O_3	0.080			
NO_2	0.20		0.10	
SP (COH)			1.0	0.5

summary of findings describes below, the existing ambient sound environment in the area is dominated by road traffic, although there was a noticeable volume of aircraft traffic overhead during this study.

Sound levels in the community change from instant to instant as a function of local and distant traffic and local activity. For this reason, some form of statistical descriptor of the sound environment is needed. In Ontario, the predominant descriptor used for noise impact assessment is L_{eq}, the energy equivalent sound level. This is the constant sound level that gives the same total sound energy over a specified time, equal to the actual variable sound levels that exist. For purposes of this analysis, a maximum one-hour period has been used.

Changes in sound exposures of 3 dBA (decibels) or less are considered insignificant and, in this context, would not be perceived by most people. Changes of 4 to 5 dBA are considered marginally significant in that they are "just noticeable". Increases of 10 dBA or more are increasingly significant, in that a 10 dBA change in sound level corresponds to a change in perceived loudness of about double the existing condition.

3.8.2 Measurement Locations and Findings

Four measurement locations, all in residential areas, were used: (See exhibit 3.8.1)

A. In the rear yard of the 279 Reiner Avenue (Buccelli Residence).
B. 25 metres east of Wilson Heights Boulevard and 20 metres north of Joel Swirsky Boulevard.
C. On the sidewalk in front of the home at 3945 Old Dufferin Street.
D. In the rear yard of 22 Faith Avenue.

Findings related to each location are briefly noted below:

Location A

The long term measurements conducted at this site were in two time periods, to obtain a comparison of the ambient sound environment during work days (weekdays) and weekend.

The sound environment remained relatively constant with little variation in the sound level descriptors throughout the measurement period. This was due to the traffic on the Allen Road, which dominated the sound environment in this area. The Allen Road has characteristics similar to a freeway, particularly south of Sheppard Avenue. Freeways typically exhibit relatively constant noise generation around the clock, contrary to the time history pattern of urban arterial, collector and local roads. Morning rush hour commenced about 6:00 a.m. and tapered off by about 11:00 a.m. Evening rush hour began at approximately 4:00 p.m. During the middle of the night and at midday, there were minor decreases in sound exposures. Sound exposure levels (L_{eq}) ranged from approximately 57 to 62 dBA during rush hour periods and in the low to mid 50's (dBA) for the "quieter" times.

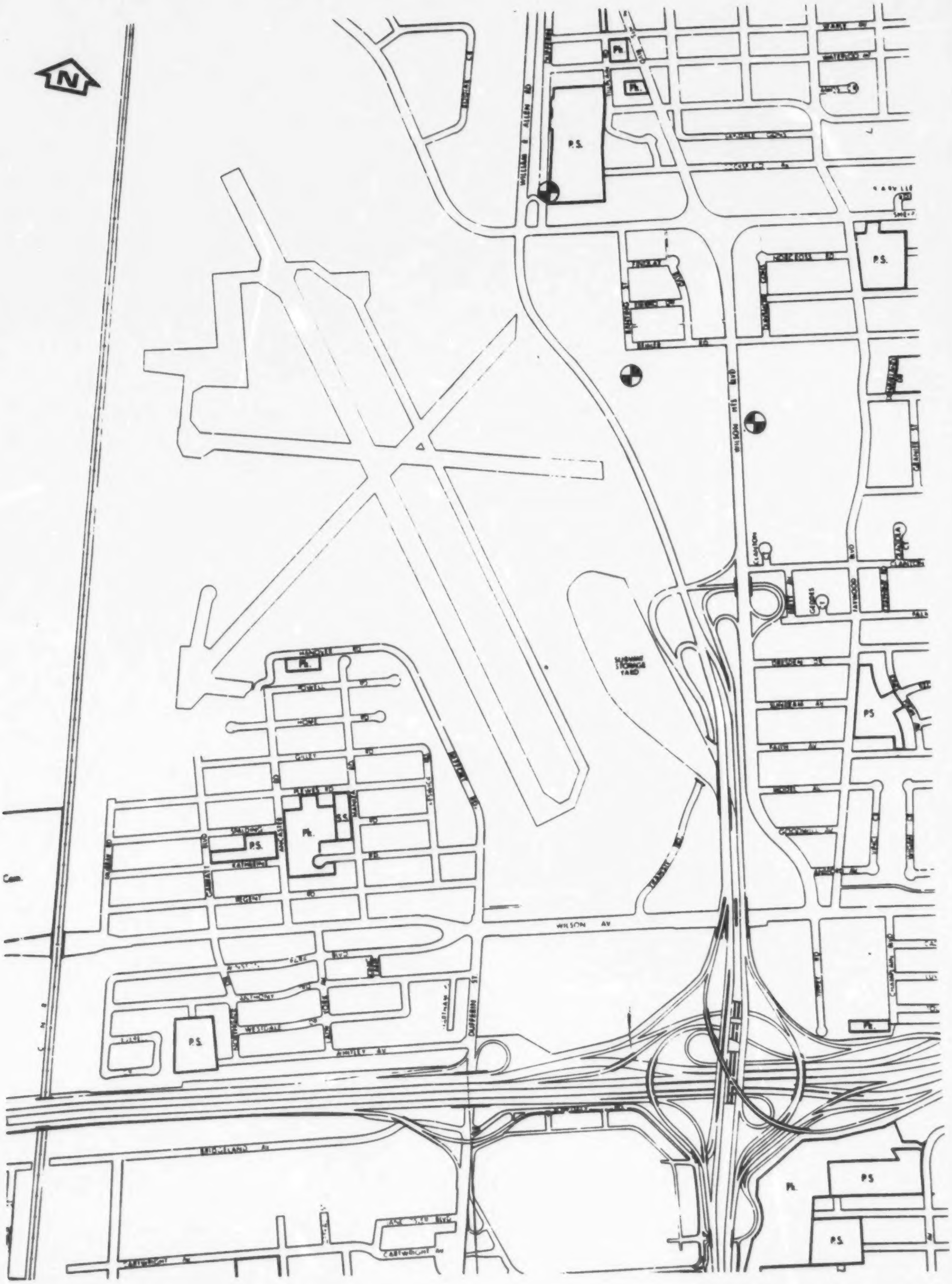
On roadways such as this, the traffic volumes may be lower on the weekends than during the week, however speeds would tend to be higher, due to a less congested traffic flow. **The result is that weekend sound exposure levels are not significantly lower than those throughout the week.**

From the measured hourly data, L_{eq24} were determined for 24 hour calendar day periods.

The L_{eq24} for Sunday was somewhat higher than for the other days. Peak hours occurred over night and at 11:00 p.m. This may be related to traffic peaks or to a neighbourhood dog barking.

DAY	L_{EQ24} (dBA)
Tuesday, October 24, 1989	58
Saturday, December 9, 1989	58
Sunday, December 10, 1989	62

Although the overall sound exposure for Sunday was the highest observed, the Sunday night/Monday morning period (December 11, 3 a.m. to 5 a.m.) exhibited the lowest sound exposures observed.


N
P.S.
Pk.
WILLIAM R. ALLEN RD
WILSON HTS BLVD
SUMMIT STORAGE YARD
WILSON AV
DUFFERIN ST
Com.
C N R
CARTWRIGHT AV

⊕ MEASUREMENT LOCATION

AMBIENT SOUND LEVEL MEASUREMENT LOCATIONS

EXHIBIT 3.8.1

Location B

At location B the measurements were carried out on Wednesday, October 25, 1989, from 1 p.m. to 5 p.m. This location was adjacent to Wilson Heights Boulevard, in the new Balmoral subdivision.

The traffic on Wilson Heights Boulevard was the dominant noise source in the area. The 2 metre high brick wall adjacent to Wilson Heights Boulevard, which was built as part of this subdivision, appeared to provide attenuation of sound from road traffic on Wilson Heights Boulevard. Allen Road was inaudible most of the time for the measurement period. There was a noticeable volume of aircraft traffic associated with Pearson International Airport overhead, during the time of the measurements.

Location C

At location C the measurements were made on Saturday, December 9, 1989 between 1 a.m. and 2 a.m. In the early morning the sound energy exposure was 56-58 dBA. Although the traffic volume on Allen road was light, it was moving at high speed, hence it became the dominant sound source.

Location D

The primary noise sources at this location were traffic using Wilson Heights Boulevard and Allen Road,and activity in the TTC Wilson Yard. Similar to the measurements made at Location A, the sound environment remained relatively constant for the same reasons outlined earlier for Location A.

Nighttime values ranged from 53 to 63 dBA and 56 to 65 dBA for the first and second nights respectively. Daytime periods exhibited values ranging from 58 to 66 dBA.

In summary, sound exposure levels range from approximately 57 to 62 dBA, during rush hour periods and in the low 50's dBA for the quieter times. The Ministry of the Environment uses 55 dBA from 7 a.m. to 11 p.m. as the sound exposure level criterion for residential outdoor spaces, with excesses of no more than 5 dBA being acceptable (up to 60 dBA) in some cases. The measured values are presently exceeding MOE criteria and implications of further noise increases will be discussed in Chapter 7.

3.9 Vibration

3.9.1 Measurement Locations and Times

Exhibit 3.9.1 shows the locations selected for ambient ground vibration measurements. These were:

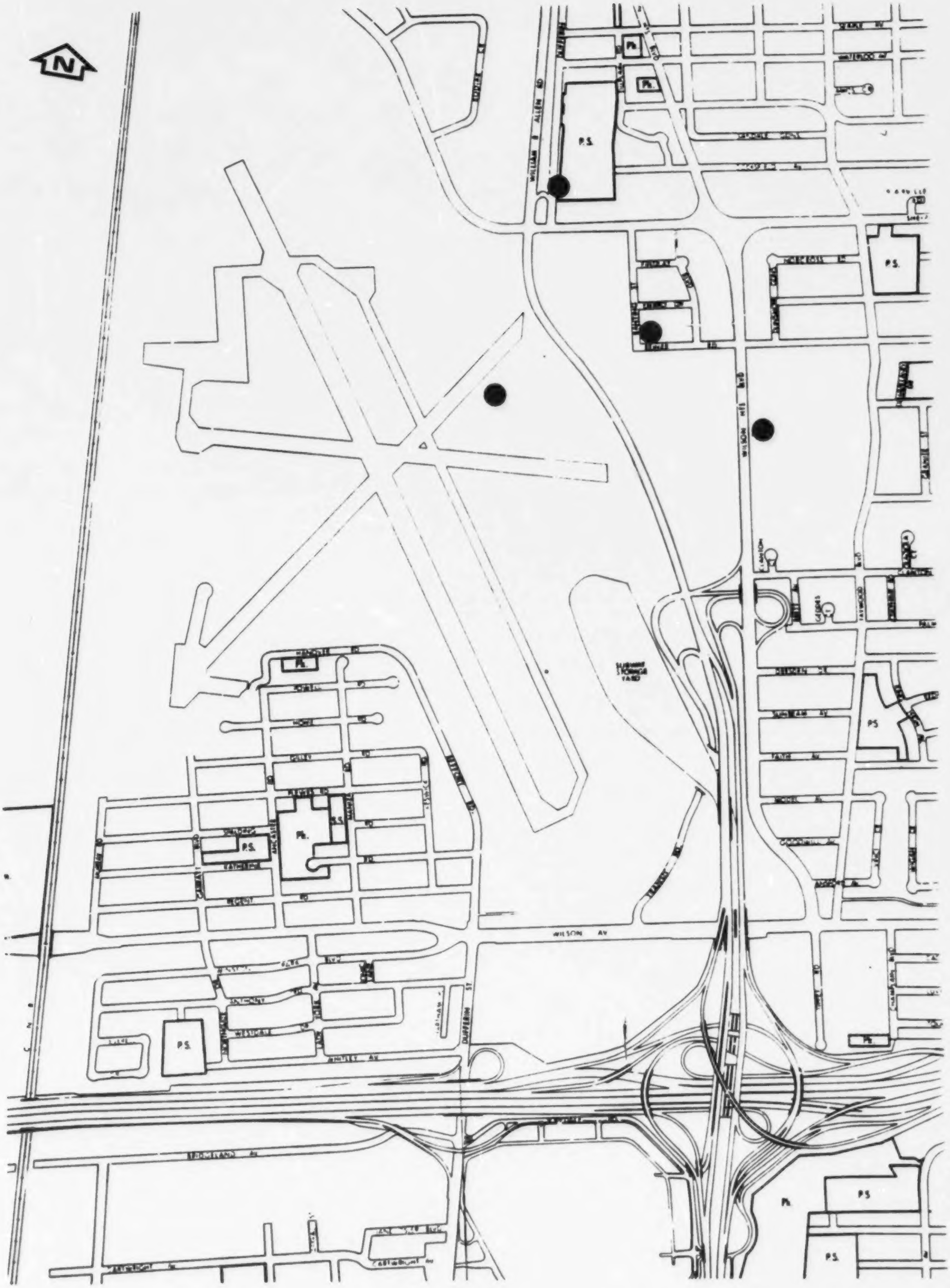
1. The ammunition magazine on the grounds of Canadian Forces Base Toronto (Downsview Airport). The transducer was placed on the concrete floor slab about one meter inside the entrance.

2. The concrete sidewalk in front of the home at 3945 Old Dufferin Street. This location is about 40 m to Allen Expressway, 64 m to Sheppard Avenue, 21 m to the bus turn-around and 25 m to the face of the house.

3. The concrete sidewalk in front of the home at 280 Banting Avenue. This location is across the street from 279 Reiner where the ambient noise measurements were made.

4. The concrete sidewalk on Joel Swirsky Boulevard 25 m from the edge of pavement at Wilson Heights Boulevard. There is no dwelling on this lot at the time of measurement but this roadway is part of a new development and residential construction is expected.

The procedure used was the spot-check type of measurement with fifteen minute recordings taken at times selected to be representative of three characteristic times of day: rush-hour, mid-day and nighttime. Thus, measurements of the ambient vibration levels were made at Locations 2, 3 and 4 during a rush-hour period, a mid-day period and a nighttime period. At Location 1 measurements were done during the rush-hour only because the concern at this location is relative to maximum vibration levels regardless of the time of day.


N
WILLIAM R. ALLEN RD
WILSON HTS BLVD
SUBWAY STORAGE YARD
WILSON AV
DUFFERIN ST
P.S.

● MEASUREMENT LOCATION

AMBIENT GROUND VIBRATION MEASUREMENT LOCATIONS

EXHIBIT 3.9.1

The times of the measurements were:

LOCATION	MEASUREMENT PERIODS
1	4:40 - 4:45 p.m.
2	5:12 - 5:27 p.m. 1:56 - 2:12 p.m. 1:16 - 1:32 a.m.
3	5:42 - 5:58 p.m. 1:34 - 1:51 p.m. 12:39 - 12:54 a.m.
4	6:10 - 6:34 p.m. (not continuous) 1:15 - 1:30 p.m. 12:15 - 12:31 a.m.

3.9.2 Measurement Scales

Evaluation of groundborne vibration has not been standardized to the extent that airborne noise has been. This is because there is relatively little information on the response of people to low level random vibration or to transient vibrations.

A number of scales for evaluating the effect of vibration on man have been devised. Units such as Pal, Trem, Gal and Comfort Index, k, have been presented for establishing scales of response to vibration, similar to the A-weighted sound level scale which is used for the determination of subjective response to noise levels. None of the vibration scales have been widely accepted in evaluating human response to vibration levels and, in general, the criteria for response are presented as charts with ranges of response as a function of vibration frequency. Most recently, partly as a result of evaluations associated with rail transit systems, overall vibration velocity level has emerged as the best measure for characterizing groundborne vibration from rail systems, because it can be most accurately measured.

As with the subjective response to noise, the human sensitivity to vibration varies with frequency. Therefore, the frequency should be taken into consideration in assessing annoyance due to vibration. However, a number of studies have indicated that sensitivity to vibration is primarily determined by the velocity amplitude and is relatively independent of frequency for the frequency range from about 8 Hz to 100 Hz.

Since the frequency range of significant groundborne vibration from rail vehicles is typically 12 tc 100 Hz, and human sensitivity is approximately independent of frequency for vibration velocity over this range, it is appropriate to present vibration criteria and data in terms of overall unweighted velocity level. Based on studies performed directly relating to groundborne vibration from rail transit systems, overall vibration velocity levels below 68-70 dB (re: 1 micro-in/sec) are normally imperceptible to the average person and are, therefore, acceptable in residential buildings.

3.9.3 Measurement Survey Results

For this survey, the recorded ground vibration velocity data were analyzed statistically by 1/3 octave bands and for overall unweighted velocity level. This results in statistical data similar to that for the ambient noise data. Thus, the vibration is described by the same statistical parameters used to describe the existing noise levels.

The existing exterior vibration sources include automobiles, trucks, buses, nearby mechanical equipment, and on a local scale, pedestrians. Most of the vibration sources, except stationary mechanical equipment operating continuously, create transient vibration levels. The observed level of vibration at a particular location is the summation of the vibrations created by all the various sources, near and distant. This is analogous to ambient community noise which represents the summation of many noise sources, near and distant.

When evaluating vibration impact, it is possible to compare the existing ambient levels measured outdoors with the vibration levels expected at the same location in the ground due to the operations of TTC subway vehicles along the proposed alignment. It is also possible to determine a predicted value of interior vibration for a particular type of building and compare that with appropriate criteria fro transit-induced groundborne vibration.

In most buildings there are other sources of vibration in addition to the groundborne vibration created by transportation vehicle traffic outside a building. In residences, appliances (e.g., refrigerators, washing machines) in addition to people walking around are the typical sources of interior vibration. In larger buildings (e.g., offices) there are also large pieces of mechanical equipment along with the occupants inside the building that are responsible for the general level of ambient vibration.

A complete tabulation of the statistical analyses of the ambient vibration velocity levels observed at each measurement site can be found in Appendix 3.9. The tabulation indicates that the ambient ground vibration in the area of the Spadina Extension is generally of very low level. For mid-day and rush-hour periods the L_{eq} is in the range of 33 to 42 dB re 1 micro-in/sec, well below the threshold of perception.

The vibration velocity level exceeded L_1 1 per cent of the time, representing the occasional maximum vibration due to heavy vehicles. This is well below the threshold of perception, with the range of 39 to 47 dB at most times and locations, and a value of 35 dB at night for one location.

At the ammunition magazine on the airport grounds, the typical maximum vibration velocity level during the rush-hour is 43 dB. Based on the results at the other locations, the daytime levels are probably as high as 47 dB at this site. It is interesting to note that the mid-day vibration levels tend to be higher than rush-hour levels. This is probably due a to change in the type of vehicles, with mostly automobiles during the rush-hour periods and more delivery and heavy trucks during the mid-day.

To further characterize the ambient ground vibration, the frequency content of the vibration has been measured. It was found that the principal frequencies for the ground vibration are in the range of 10 Hz to 25 Hz. This is typical for rubber-tire vehicle traffic in an area with a deep layer of relatively soft soils (bedrock relatively deep). The levels are fairly random in distribution, are highest for the locations nearest major roadways and diminish with increasing distance from major roadway. All these factors are normal and indicate no unusual aspects to the ground vibration in the Spadina Extension area. The ambient levels are generally lower than those found in more densely populated urban areas, due to the relatively low density of major roadways in the area.

3.10 Utilities

Areas in the vicinity of the proposed alignments are currently serviced by North York Hydro, Consumers Gas, Bell Telephone, and local sanitary sewer, water and storm sewer facilities. These utilities do not represent a problem in terms of the engineering impact of the proposed Undertaking. In the absence of capacity modifications, current limitations in sanitary trunk sewer facilities do, however, severely restrict associated development at present. However, system improvements are planned.

3.10.1 Consumers Gas

Gas mains are located in four principal locations in the vicinity of the proposed Undertaking[25]. These include:

- a gas main commencing at a point 150 metres east of the intersection of Sheppard Avenue and W. R. Allen Road running east along the south side of Sheppard Avenue and then south along the west side of Wilson Heights Boulevard;
- a gas main commencing at a point approximately 60 metres north of Sheppard Avenue and proceeding north along Dufferin Street;
- a gas main running along the south side of Wilson Avenue; and
- a header service (gas main on private property) commencing at Wilson Avenue and running north to the TTC railway yard.

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[25] Toronto Transit Commission. Engineering Department. Sheppard Subway - Existing Utilities. Drawing Nos. 0190-U-1000 to 1002 and 1012 to 1013. (Toronto: Toronto Transit Commission, 1988); Phyllis Brown. Consumers Gas. Personal Communication. (Toronto: January 1990).

More detailed information regarding the location of gas utilities has been requested in writing from the Planning and Technical Department of Consumers Gas. Prior to design and construction, arrangements will also be made for on-site locates of all utilities.

3.10.2 North York Hydro

Primary hydro lines are located in four principal locations in proximity to the proposed alignments[26]. These include:

- a cable running along the north side of Sheppard Avenue;
- a cable running along the west side of W. R. Allen Road with a tangent veering off to the TTC railway yard;
- a duct running along the east side of W. R. Allen Road; and
- a cable running west along Clanton Park Road, entering the TTC railway yard, and proceeding south to Wilson Avenue.

More precise information regarding the location of hydro facilities in the area has been requested in writing from North York Hydro's Engineering Department. Prior to design and construction, arrangements will also be made for on-site identification where necessary.

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[26] Toronto Transit Commission. Engineering Department. Sheppard Subway - Existing Utilities. Drawing Nos. 0190-U-1000 to 1002 and 1012 to 1013. (Toronto: Toronto Transit Commission, 1988); North York Hydro. Personal Communication. (Toronto: January 1990).

3.10.3 Bell Telephone

A primary telephone cable runs east along Sheppard Avenue from a point 100 metres east of the intersection of Sheppard Avenue and W. R. Allen Road[27].

More detailed information on the location of telephone facilities has been requested in writing from the Utilities Coordination department of Bell Canada. Prior to construction, arrangements will also be made for on-site locates.

3.10.4 Sanitary Sewer

A 250mm diameter sanitary sewer flows eastward from Dufferin Street along the north side of Sheppard Avenue. This sewer connects to the North York sub-trunk and then discharges to the West Don Sanitary Trunk Sewer. Previous studies (Sheppard West Study, November 1987 and April 1989) have indicated that there is currently a deficiency in the local sanitary sub-trunk capacity[28]. Additional capacity to accommodate further growth on Sheppard Avenue West would involve the construction of a new sewer along Sheppard Avenue, from Dufferin Street and east past Bathurst Street, connecting to the West Don Trunk Sewer.

In addition, most of the remaining capacity in the West Don Trunk Sewer is allocated for future development permitted in the Official Plan. Improvements to the system in the Study Area to allow for further development are, as noted earlier, in planning stages.

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[27] Toronto Transit Commission. Engineering Department. Sheppard Subway - Existing Utilities. Drawing Nos. 0190-U-1000 to 1002 and 1012 to 1013. (Toronto: Toronto Transit Commission, 1988).

[28] Toronto Transit Commission. Engineering Department. Sheppard Subway - Existing Utilities. Drawing Nos. 0190-U-1000 to 1002 and 1012 to 1013. (Toronto: Toronto Transit Commission, 1988); North York Planning Department. Sheppard West Study. Background Report and Secondary Plan Alternatives. (North York: 1987). North York Planning Department. Sheppard West Study. Report on Submissions and Proposed Secondary Plan. (North York: 1988).

3.10.5 Watermains and Storm Sewers

A 400mm diameter watermain is located on the north side of Sheppard Avenue. Storm drainage is split between two systems; a sewer flowing eastward from Dufferin Street on the south side of Sheppard Avenue and another sewer flowing westward from Dufferin Street in the north half of the Sheppard Avenue roadway.

3.11 Archaelogical Concerns

There are no archaeological sites registered by the Ministry of Culture and Communications (MCC) in the vicinity of the proposed rapid transit project. This may be due to a lack of past investigative work in the area. MCC's concerns would centre on local watercourse crossings and any areas minimally disturbed in the past. Except for the triangle of TTC land between Wilson Heights Boulevard and Allen Road, this would refer to land on the west side of the Allen-Dufferin right-of-way.

MCC recommends that some historical and archaeological survey work be carried out on any relatively undisturbed ground within the proposed right-of-way.[29] To these ends MCC will be recontacted for comment upon selection of the preferred route. On-site field inspection would be carried out along the surveyed right-of-way prior to construction.

3.12 Heritage Resources

Investigation determined that no heritage resources would be adversely affected by the proposed Undertaking.

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[29] Carruthers, P. (MCC) 1989 letter to Myron Humeniuk, October 2, 1989.

There are a number of heritage structures in the vicinity but none are within the study corridor. These buildings include :

- World War 1 Hangar - Canadian Forces Base Toronto
- Ella Church (1901) - 1130 Finch Avenue West
- Downsview United Church (1870) - 2822 Keele Street
- John Bales House (c. 1824) - 4169 Bathurst Street

The response to our inquiry to the North York Historical Board (September 22, 1989) also reiterated that the valleys of Black Creek and the West Don River are important for heritage and environmental concerns.

4.0 NEEDS ASSESSMENT AND JUSTIFICATION FOR RAPID TRANSIT NETWORK EXPANSION AND THE UNDERTAKING

4.1 Problem Statement

Traffic congestion in the Greater Toronto Area (GTA) is affecting the capability of the road system to effectively move people and goods. In particular, roads across the York Region/Metropolitan Toronto boundary between Dufferin Street and Bayview Avenue are presently experiencing traffic volumes that are at, or approaching theoretical capacity. Based on projections of future travel, this growth will result in a worsening of a problem that is already severe.[1] As noted in Section 3, growth in traffic volume between York Region and the Secondary Study Area is reducing the average operating speed of both cars and transit vehicles. (See Section 3.4.1)

The potential cost to the GTA and to Metropolitan Toronto of a congested road network, in the absence of transportation improvements, could be a decline in economic growth and employment.

In its report to the Ontario Minister of Transportation[2], the Transit Advisory Group noted that:

"the share of the rapidly growing total cross-boundary trips carried by transit will have to increase significantly if traffic chaos is to be avoided, because it is impossible to build enough new road lanes to carry the additional travellers by car".

Similarly, the review of Metropolitan Toronto roads by the Municipality of Metropolitan Toronto as part of its Official Plan review[3] resulted in the conclusion that:

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[1] North-West Metro Transportation Study

[2] Crossing the Boundaries - Report of the Transit Advisory Group to the Minister of Transportation for Ontario. (1987)

[3] Metropolitan Official Plan Review: Background Paper No. 8, Metropolitan Roads. Transportation Division of the Metropolitan Planning Department (August, 1989) p.45.

> "The limitations of improvements to the road systems also necessitate that actions be undertaken to modify the propensity for automobile use. These actions should include improvements to inter- and intra-municipal transit, intensification of land use to make rapid transit options practical and demand management programs such as variable work hours or employer sponsored car/van pools."

4.2 Statement of Need

The preceding overview of the problem of decreasing mobility highlights the need for rapid transit network expansion in the Secondary Study Area as a means of achieving a balanced transportation system. This need can be summarized as follows:

> Rapid transit expansion is needed to improve accessibility and mobility within north Metropolitan Toronto and across its boundary with York Region.
>
> This expansion will provide an integrated, cost-effective, safe and environmentally sound transit alternative to balance on-going road improvements and to offset increased reliance on the automobile.
>
> The proposed Undertaking is a pre-requisite for completion of a series of rapid transit network expansion initiatives currently under consideration for this study area.

The following sub-sections present, in more detail, the existing and projected future demographic, employment, labour force and travel pattern trends which are contributing to the problem and which justify Rapid Transit Network expansion and the proposed Undertaking.

4.3 Outlook for Growth and Development

4.3.1 Demographic, Employment and Labour Force Trends and Outlook

In 1989, Metropolitan Toronto Planning Department's Research and Policy Divisions, in cooperation with regional and provincial representatives and coordinated by the "Greater Toronto Coordinating Committee", completed population and employment growth scenarios to the year 2011 for the Greater Toronto Area (GTA). Of the six scenarios provided in the report[4], a population growth target of 2.5 million has been adopted by Metro Toronto for planning purposes as the most likely to occur. These figures form the basis for the following discussion, along with labour force statistics which have been developed by Metropolitan Toronto using Scenario "E" forecasts as a base.

As Table 4.2.1 indicates, Metropolitan Toronto is projected to fall to below half of the GTA's total population (from 58.7% in 1986 to 48.3% in 2011). The major gains will go to York and Peel Regions, which will each experience growth in population approximating 400,000 by 2011. Similarly, Metro's share of the Region's total employment is forecast to decline significantly, from 65% down to 55% in 2011, although in absolute terms the increase is projected to be 288,000 or 32% of total regional employment growth.

Employment growth is expected to be greatest in Peel Region, where levels are projected to rise in absolute terms by 288,000 (1986-2011), and in Regional share terms, from 14.9% to 20.2%. Employment in York Region is forecast to double over the same period, and regional share to increase from 8.4% to 11.7%. Durham Region's projected growth is also impressive in absolute (+110,000) and relative (5.8% up to 7.8%) terms.

With the exception of Halton Region, the ratio of employment to population is expected to rise, for all Regional Municipalities reflecting a continued strong economic base within the GTA.

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[4] Metropolitan Toronto Planning Department. Projections and Their Policy Implications. (April, 1989).

Projected labour force figures provide an interesting basis for examining future travel patterns. By 2011, **Metro's labour force is projected to increase by only 19,000** over 1981 levels, while **Regions such as York and Peel are forecast to experience growth in the labour force of 185,000 and 307,000**, respectively. These figures, together with the forecast of an increase in Metro employment of 288,000, suggest increased inter-regional work trips into the Central Area. Indeed, **with a projected labour force of 1.226 million and employment of 1.606 million for Metropolitan Toronto by 2011, the shortfall of 400,000 jobs will have to be filled by non-Metro residents.**

Because of the robust forecasts of employment growth for regions surrounding Metro, **inter-regional work trips out of Metro into the regions can also be expected to increase.** For example, in the case of York Region, its projected labour force of 318,000 will be insufficient to accommodate the anticipated 342,000 jobs forecast, necessitating therefore, the "importing" of workers to the Region. This trend will be reinforced if the Metropolitan Toronto Planning Department's following policy recommendation is successfully pursued:

> "In order to reduce the level of in commuting into Metro Toronto and shorten work trips, the regions surrounding Metro should be encouraged to attract a greater proportion of the Metropolitan Region's [GTA] employment growth by adopting a centres policy in their regional and local plans."[5]

These projections point to the need for the transportation network to accommodate significant increases in inter-regional trips between York and Peel Regions and Metropolitan Toronto. As Section 4.4 will underscore, an already congested road network makes the accommodation of these forecast trips problematic.

4.3.2 Urban Development Outlook

Urban development trends also suggest additional pressures on the road transportation network.

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[5] Municipality of Metropolitan Toronto. Metropolitan Plan Review: Centres & Office Areas. Report No. 9 (1989) p. 85.

TABLE 4.2.1
POPULATION AND EMPLOYMENT PROJECTIONS BY EACH OF FIVE REGIONS IN THE GREATER TORONTO AREA (GTA)
1986 - 2011

Region	1986	2001	Change % / % pts	2011	Change % / % pts
Metro Toronto					
• Population	2,192,721	2,464,100	12.4%	2,527,400	2.6%
• Share of GTA population	58.7%	52.1%	-6.6pts	48.3%	-3.8pts
• Employment	1,320,000	1,612,400	16.7%	1,606,600	4.3%
• Employment as per cent of total Region	65.0%	58.8%	-6.2pts	55.1%	-3.7pts
• Employment as per cent of population	60.0%	62.5%	2.5pts	63.6%	1.1pts
• Labour Force	1,275,365	1,245,914	-2.3%	1,226,646	-1.6%
• Regional Share	59.4%	52.0%	-7.4pts	48.2%	-3.8pts
Durham Region					
• Population	326,179	490,300	50.3%	580,000	18.3%
• Share of GTA population	8.7%	10.4%	1.7pts	11.1%	0.7pts
• Employment	*117,000	214,500	83.3%	227,000	5.8%
• Employment as per cent of total Region	5.8%	7.8%	2.0pts	7.8%	0.5pts
• Employment as per cent of population	35.9%	43.8%	7.9pts	39.1%	-4.7pts
• Labour Force	176,680	204,822	15.9%	227,419	11.0%
• Regional Share	8.2%	8.5%	0.3pts	8.9%	0.4pts
York Region					
• Population	350,607	579,000	65.1%	743,000	28.3%
• Share of GTA population	9.4%	12.2%	2.8pts	14.2%	2.0pts
• Employment	170,612	307,800	80.4%	342,000	11.1%
• Employment as per cent of total Region	8.4%	11.2%	2.8pts	11.7%	0.5pts
• Employment as per cent of population	48.7%	53.2%	4.5pts	46.0%	-7.2pts
• Labour Force	195,010	274,521	40.8%	318,792	16.1%
• Regional Share	9.1%	11.5%	2.4pts	12.5%	1.0pts
Peel Region					
• Population	592,169	855,500	44.5%	1,012,400	18.3%
• Share of GTA population	15.9%	18.1%	2.2pts	19.3%	1.2pts
• Employment	301,813	445,400	47.6%	589,800	32.4%
• Employment as per cent of total Region	14.9%	16.2%	1.3pts	20.2%	4.0pts
• Employment as per cent of population	51.0%	52.1%	1.1pts	58.3%	6.2pts
• Labour Force	346,455	495,740	43.1%	579,365	16.9%
• Regional Share	16.1%	20.7%	4.6pts	22.8%	2.1pts
Halton Region					
• Population	271,389	339,000	24.9%	375,000	10.6%
• Share of GTA population	7.3%	7.2%	-0.1pts	7.2%	0.0pts
• Employment	*110,000	162,800	48.0%	150,100	-7.8%
• Employment as per cent of total Region	5.4%	5.9%	0.5pts	5.1%	0.8pts
• Employment as per cent of population	40.5%	48.0%	7.5pts	40.0%	-8.0pts
• Labour Force	154,215	176,410	14.4%	190,266	7.9%
• Regional Share	7.2%	7.4%	0.2pts	7.5%	0.1pts
Greater Toronto Area					
• Population	3,733,065	4,727,900	26.7%	5,237,800	10.8%
• Share of GTA population	100.0%	100.0%	-	100.0%	-
• Employment	2,019,425	2,742,900	29.7%	2,915,500	11.3%
• Employment as per cent of total Region	100.0%	100.0%	-	100.0%	-
• Employment as per cent of population	54.1%	55.4%	1.3pts	55.7%	0.3pts
• Labour Force	2,147,725	2,397,407	11.6%	2,542,488	6.1%
• Regional Share	100.0%	100.0%		100.0%	-

Note: * = Estimate

Sources: Metropolitan Toronto Planning Department. Projections and Their Policy Implications. (April, 1989) Table P.1.

Metropolitan Toronto Planning Department. Metropolitan Plan Review: Metropolitan Roads. (August, 1989) Tables 1 and 2.

Metropolitan Toronto Planning Department. Metropolitan Plan Review: Central Area Transportation Issues. Report No. 6 (1988), Exhibit 6.

The North York Centre

North York Official Plan Amendments have received approval which would permit employment in the Centre to grow to 63,000 and population, to 27,000. Current limitations have been set at 51,000 jobs and 15,800 population, subject to a review of transportation facilities. According to Metropolitan Toronto's recent review of its Official Plan,[6] the Centre, in view of market forces, will continue to attract growth. Thus, there is a defined need for an east-west rapid transit line to accommodate the growth desired by both Metropolitan Toronto and the City of North York for this Centre.

The Downsview Airport Lands

Although the Department of National Defence has indicated that, for the foreseeable future, this land will be confined to military and air transportation-related uses, both Metropolitan Toronto and the City of North York have designated the lands as a "Special Study Area", in the event that over the next twenty years, the needs of the Department of National Defence should change. The Sheppard West Study, which has been deferred by North York Council, noted that:

> "the lands however, in terms of their size, location and potential for future development are recognized as being of major significance to North York, as well as to Metro."[7]

Were these lands to be released for development, their capacity for development would, potentially, be large.[8]

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[6] Municipality of Metropolitan Toronto. Metropolitan Plan Review: Centres and Office Areas, Report No. 9 (1989. p.53.

[7] North York Planning Department. Sheppard West Study: Report on Submissions and Proposed Secondary Plan. (April, 1989) p.14.

[8] A report cited in the Northwest Metro Transportation Study indicates that a Federal report on development potential concluded that "if the physical plant at the Canadian Forces Base Toronto was rationalized at least 250 acres would be available for residential and limited commercial use, enough to house 15,000 people." (p.136)

York University

The Downsview Campus of York University is the subject of a secondary planning exercise being conducted by a sub-committee of the North York Planning Advisory Committee (PAC). The secondary plan is to establish development limits, policies and thresholds for these lands. The sub-committees's recently adopted timetable indicates recommendation of a secondary plan to the PAC in January, 1991.

Research by York University into transit use to the York Campus has indicated that a significant proportion of the existing transit ridership to the campus is via the Spadina subway. This is due in no small part to the general superiority of rapid transit over local bus systems.

By virtue of the University area's proximity to Highway 400, future Highway 407 and the Bradford GO Transit line, it is viewed as a potentially valuable multi-modal gateway centre, facilitating in and outbound commuting.

The Sheppard Avenue/Allen Road Area

While the recommendations of the City of North York's Sheppard West Study have been deferred, the study's analyses document an on-going upward pressure on densities in the vicinity of this intersection.[9]

With the preceding growth and development outlook as background, an analysis of the ability of the present transportation systems to accommodate existing and projected future needs is necessary to assess the magnitude of the problem.

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[9] The study also notes the sanitary trunk and sub-trunk capacity and the need for intersection improvements as constraints on increased development in the area, pending reallocation of existing capacity and/or trunk expansion, and development of solutions to congestion.

4.4 Travel Patterns and Projected Travel Demand

The preceding discussion of demographic and economic trends and forecasts for the future of north Metro and southern York Region are supportive of the conclusion reached in the Ministry of Transportation of Ontario's report Transportation Directions for the Greater Toronto Area, that:

> "There will be a substantial increase in trips across all three Metro boundaries during peak periods. This increase will consist of inbound commuters destined for jobs downtown and in the major city centres of North York, Scarborough and Etobicoke. Outbound commuters from Metro will also form an important and growing component of future travel demand." (p.2)

This emerging travel pattern will have a significant impact on both road and transit systems in the primary and secondary study areas for this undertaking.

Travel patterns identified in the Transportation Tomorrow Survey conducted in 1986, show a large number of trips from York Region destined for downtown Metro (13,500 a.m. peak trips). The 1986 a.m. peak trips between York Region and the area of Metro north of Highway 401 are also significant, numbering 12,400. The propensity for travel between these zones, superimposed on the local travel demand within the study area is the underlying cause of the **present congestion, which has steadily worsened since the 1986 survey.**

The Northwest Metro Transportation Study[10], undertaken in 1988, projected significant growth in trips across the York/Metro boundary over the twenty year study period. Across the Steeles Avenue boundary between the Humber River and the CN Newmarket Subdivision 110% growth is predicted, while between Bayview Avenue and the CN Newmarket Subdivision, 149% growth is forecast. These projections translate into 20,000 additional trips per day across Steeles Avenue.

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[10] Municipality of Metropolitan Toronto. Northwest Metro Transportation Study. (March, 1988)

Historical information collected during the Transportation Tomorrow Survey in 1986 indicates the propensity for individual trip-making has increased at a rate of 1% per year. Data from the Regional Municipality of York's Profile 1989 report and employment and employed labour force projections by Toronto Area Region Modelling Study (TARMS) zone supplied by Metropolitan Toronto Planning Department, permit calculation of the projected travel demand impacting the secondary study area. If the trip-making propensity trend continues, calculations indicate that the demand for access to the downtown core by residents of the study area will increase to 28,500 a.m. peak hour trips in 2011 from the current 23,900. This growth can be considered moderate. However, trips into and through the Study Area will see greater increases. Trips from Vaughan and Richmond Hill are forecast to rise at more than 10% per year from the current level of 3,000 to more than 10,000 trips in the a.m. peak hour. Trip-making between southwest Vaughan region and the study area will also grow. The a.m. peak hour volumes will increase from 8,000 to 13,800 over the 20 year horizon (1991-2011).

The current capacity limitations at the York/Metro boundary, along with the high forecast travel demand, were identified in the Northwest Metro Transportation Study as an issue worthy of specific study. It was also noted that approximately half the York/Metro automobile trips are destined to North Metro (above Highway 401).

As noted earlier in this section, the summary of these study findings on inter-regional travel states that roads across the York/Metro screenline between Dufferin Street and Bayview Avenue are presently experiencing traffic volumes that are at or approaching theoretical capacity. Also, the projected greatest growth in travel within the area studied is associated with the York/Metro boundary screenline in the Dufferin to Bayview corridor. The study noted that **this growth will result in a worsening of a problem that is already severe.**

In 1987, the findings of the report of the Transit Advisory Group to the Ontario Minister of Transportation, Crossing the Boundaries noted that the share of the rapidly growing total cross-boundary trips carried by transit will have to increase significantly if traffic chaos is to be avoided, because it is impossible to build enough new road lanes to carry the additional travellers by car.

This report also cautioned that the rate of increase of transit modal share will depend on the **ease of transit travel**, that is, on the degree of success in solving present problems of service coordination, fare integration and planning coordination. In recent years on-going initiatives have been pursued to encourage integration of transit travel on TTC, GO Transit and the regional transit services. Further success in this direction will depend on the ability to plan and implement **rapid transit network expansion** and service integration opportunities to meet the growing demand for convenient, rapid service and to encourage travellers to divert to transit use.

4.5 Road System Inability to Meet Future Mobility Needs

The need for the proposed Undertaking, as stated in Section 4.2 of this document, is to contribute to the balanced transportation system necessary to improve mobility and accessibility and reduce increased reliance on the automobile. As has been suggested in several studies, improvement of the roads system alone, is not an adequate response to the current levels of congestion and forecast travel demand in and around the Secondary Study Area.

This becomes evident from the following review of the ability of road system improvements to meet the key criteria for efficient transportation in the growing Greater Toronto Area.

While several proposals to increase the capacity of the secondary study area road system are currently being studied, (e.g. addition of a lane between Sheppard and Steeles Avenues on Bathurst Street; widening of Sheppard Avenue between Allen Road and Highway 404) these represent only a small part of the improvements needed to alleviate the existing congestion and respond to the growth in travel demand predicted for the area.

In order to achieve a significant level of service benefit, major improvements would be necessary such as expansion of expressways with grade separated intersections and development of more reserved bus lanes for surface transit routes. In the North Metro area, this approach is impractical as present road allowances are limited in width. Expansion of the rights-of-way would be costly and would also cause disruption to the existing built environment in the form of property acquisition, demolition of homes and businesses, limitation of access and disturbance to the social/community fabric.

Even if these major improvements were pursued, reliability of travel would not be assured as capacity through the study area could be jeopardized by excessive volume in downstream corridors such as the Allen Expressway or Highway 401. Maintaining or improving trip times will also be difficult since the growth projections discussed in Section 4.3. suggest that any capacity increases in the study area road system will be matched by traffic volume growth. Also, corresponding capacity increases in downstream rights-of-way would be difficult and probably unacceptable due to the constraints of the built environment.

In addition to the above socio-economic issues, expansion of the road system raises several other potential environmental concerns. Emissions generated by high volume automobile corridors and noise levels from expressways in urban settings are impacts which may exceed acceptable standards. As well, the infrastructure required for road improvements could adversely affect urban vistas and streetscapes.

A further consequence of a commitment to road improvements alone is an increasing reliance on the automobile by the travelling public. This severely limits the transportation options for non-car owners (e.g. the mobility disadvantaged, seniors, youth and low income segments.)

Notwithstanding highway design standards, high capacity roads or expressways remain vulnerable to weather-related accidents or delays. The acknowledged convenience of private car use is also being offset by the increased stress and frustration of severe traffic congestion as well as the growing lack of affordable parking and its remoteness from destinations.

Recognizing these limitations to improvement to the road system, the Provincial Government in its May 1988 policy statement on Transportation Directions for the Greater Toronto Area, noted that:

> "Responding to the need for more capacity within our provincial and municipal road networks is essential for sustained growth, but it only addresses part of the challenge. In order to meet future demands, we must balance the need for both roads and transit. Transit has played an essential part in the development of the GTA into the urban centre we know today - and it will have an even stronger role to play in the future."

It also concluded that:

> "Our ability to attract large segments of the population with effective, high-quality transit throughout the GTA will be essential to managing traffic congestion and promoting city centres and sub-centres. Transit is the preferred method for moving people."

In the context of "Immediate Transit Initiatives", the Province stated in the report that it will assist the GTA municipalities and the TTC to immediately undertake a joint review of opportunities to extend Metro Toronto's rapid transit network (i.e. the existing subway/RT network). This approach to **meeting future mobility needs** recognizes the several roles which a comprehensive rapid transit network fulfils in a metropolitan area.

4.6 Opportunities Provided by Rapid Transit Networks to Meet Future Mobility Need

The justification for expansion of the existing rapid transit network achieved in part through the proposed Undertaking is reinforced by a discussion of the opportunities and the benefits flowing from rapid transit in contrast to a strategy which would advocate roads expansion only.

- **Rapid transit networks provide an efficient alternative to the automobile...**
  The traveller's reliance on the automobile is reduced if a rapid transit network is in place offering a **fast, reliable, convenient and extensive alternative.** Due to its basic characteristics - separated right-of-way, high-capacity cars coupled in trains with 500-1250 passenger capacities, electric traction, rail (or other guided) technology and signal control - **rapid transit represents by far the highest performance transit mode**. Typically it has capacity, speed, reliability, comfort and other characteristics much greater than any other transit mode. An extensive rapid transit network also offers a transportation option for non-car owners.

  Although rapid transit in some forms is very capital-intensive, it is also durable and at large passenger volumes it requires lower operating costs per passenger-km than any other mode. For over thirty years, Metro residents with access to the TTC subway and RT lines have enjoyed these benefits. During this period reliability and comfort was assured by frequent surface transit operating on an uncongested arterial road system feeding a subway system not yet at capacity. In recent years, this situation has deteriorated.

- **Rapid transit networks provide a "backbone" to the transit system...**
An extensive rapid transit network usually serves as the basic "backbone" or skeleton of an entire transit system, integrating street transit services into a unified network and attracting automobile users via park-and-ride facilities. The growth of private automobiles in cities has created such severe congestion that the only reliable alternative is the construction of public transit in separate rights-of-way, i.e. rapid transit systems; without them central cities are often choked.

To attract automobile users for a large variety of urban trips, transit must offer a high level of service within an integrated network: this calls for rapid transit in the role of network integrator. The TTC's present rapid transit system is well known internationally as the **"backbone"** of Metro Toronto's multi-modal transit network. Integration of the subway/RT and surface routes is a hallmark of the TTC system. Presently 131 out of 137 surface routes make direct connections with the subway or RT.

- **Rapid transit networks offer high speed urban links...**
Rapid transit networks can respond to the need for improved access to major business and shopping districts by providing high capacity links to service high demand within the core of the urban area. For example, ridership on the Yonge and Bloor Subways in the core has now reached daily figures of 185,000 and 170,000 respectively.

Metro Toronto is now emerging as a multi-centred urban pattern with a growing demand for mobility between the sub-centres and downtown as well as between the sub-centres themselves. A more extensive network providing high speed urban links between these nodes is now justified.

- **Rapid transit networks attract riders from surrounding regions...**
In addition to the role as an urban link between sub-centres or suburbs, most mature rapid transit networks carry large numbers of passengers, mostly commuters, between surrounding regions or satellite towns and the centres and sub-centres of the urban area.

The rapid spatial expansion of cities and their surrounding regions has also created a need for extension of rapid transit lines further into suburbs. Several recently built networks worldwide, eg. Washington or Atlanta, extend much farther into suburbs than older systems.

In this role, the success of effective networks stems from efficient integration with inter-regional bus and commuter rail services as well as the ability to intercept automobile travellers at key locations on their desired routes, thus getting travellers out of their cars. In the Greater Toronto Area, the need for this role has been recognized and the Province has outlined the following general principles in developing their Immediate Transit Initiatives.[11]

- Rail services (streetcars, subway, RT and commuter rail) are the main network around which local bus services must be developed. Specific initiatives to coordinate services, integrate fares and selectively upgrade commuter rail and subway services are essential to the development of the overall network.

- Work with the municipalities and transit operators to extend fare integration to all parts of the Greater Toronto Area and move towards the day when anyone will be able to move conveniently by transit throughout the GTA. This will work towards increasing the productivity of existing systems.

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[11] Ministry of Transportation of Ontario, Transportation Directions for the Greater Toronto Area, May, 1988.

- Identify and protect strategically-located gateway sites and develop links from these sites to major transit lines as soon as possible. Implementation of the transportation gateways concept is a key component of the regional transit strategy. Gateways will be focal points in the transportation network which will substantially increase the use of transit in the areas of greatest traffic congestion around Metro Toronto.

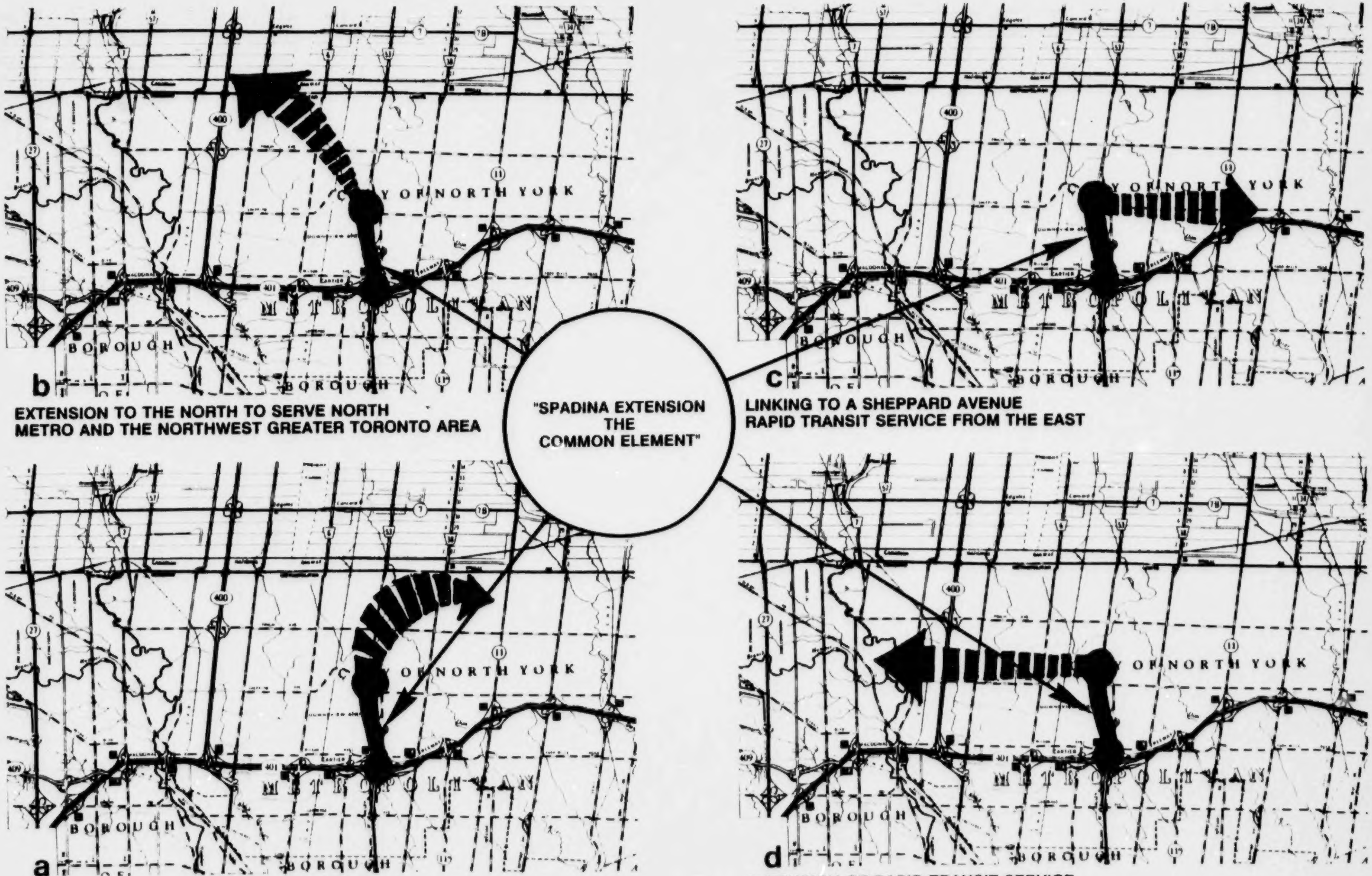
Not only will gateways provide interchange points where people can move from cars to transit or from buses to high-speed transit, they will also attract services which cater to the needs of commuters, such as banking, shopping and day care centres. In addition, gateways will serve intercity buses and car pools, and provide a transfer location for the special transit services used by disabled travellers. These sites will become urban nodes of appropriate residential, commercial and recreational development throughout the GTA.

4.7 Spadina Subway Extension - the Common element of Rapid Transit Network

As the policies and reports cited in Section 1.0 indicate, there is now a general recognition that major expansion of Metropolitan Toronto's rapid transit network cannot be postponed any longer. It is now eleven years since completion of the last significant subway construction, the extension of the Spadina Subway up to Wilson Avenue and five years since the Scarborough RT service was opened.

Numerous recent studies of transportation needs in the GTA have identified rapid transit network expansion options which are aimed at solving several existing and emerging mobility problems in north Metro and the adjacent regions and which are supportive of Metro's Official Plan policies.

The relationship of this undertaking to these network expansion options is evident in Exhibit 4.7.1. **The Spadina subway extension between Wilson station and Sheppard Avenue is the important common element** in the possible network expansions proposed by the various concerned jurisdictions, namely the Province, Metro Toronto and the City of North York.


"SPADINA EXTENSION
THE
COMMON ELEMENT"
CITY OF NORTH YORK
METROPOLITAN
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b EXTENSION TO THE NORTH TO SERVE NORTH METRO AND THE NORTHWEST GREATER TORONTO AREA

c LINKING TO A SHEPPARD AVENUE RAPID TRANSIT SERVICE FROM THE EAST

a EXTENSION NORTH AND EAST TO FORM A LOOP WITH THE YONGE STREET SUBWAY

d EXTENSION OF RAPID TRANSIT SERVICE WEST FROM ALLEN ROAD SERVING NORTHWEST METRO

FUTURE NETWORK POSSIBILITIES

EXHIBIT 4.7.1

In each case the extension forms a link between the existing subway network and a future expanded network serving North Metro and the northern regions. This future network will have a major role in responding to the significant increase in cross boundary travel demand between York Region and Metro implied by the population and employment growth anticipated in the GTA.

4.8 Subway Network Expansion Options

Options which have been studied and evaluated to varying degrees include:

a) The Spadina - Yonge Subway Loop Option

After assessing several system expansion options for north Metro, the North Metro Boundary Transportation Review recommended a subway loop option which includes:

- Extending the Spadina Subway north on Dufferin street, then east along the Finch Avenue/Steeles Avenue corridor to form a loop with the Yonge Subway;
- Approximately 18 km of exclusive busway east of Yonge Street and west of Dufferin Street.

Pursuing this option offers several benefits which respond to the planning and transportation objectives outlined earlier in this section. Specifically this option:

- Creates a transit response to unmet travel demand, particularly in the high-growth Yonge corridor between York Region and Metro Toronto;
- Supports development of the entire North York City Centre;
- Provides about 10 percent increase in Yonge Subway capacity, by allowing an increase in train frequency (headway) not possible with the existing terminals at Finch and Wilson Stations. This increase could be up to 40 percent of present capacity if signalling and station improvements allowing 90 second headways are also implemented.

- Alleviates Yonge subway congestion by making use of reserve capacity on Spadina line;
- Provides a cost-effective transportation solution that can be implemented in a reasonable time-period.

The north-west quadrant of the loop would also improve access to York University while the loop concept overall increases reverse flow potential in the form of commuter trips to the growing employment centres in N.W. Metro and southern York Region.

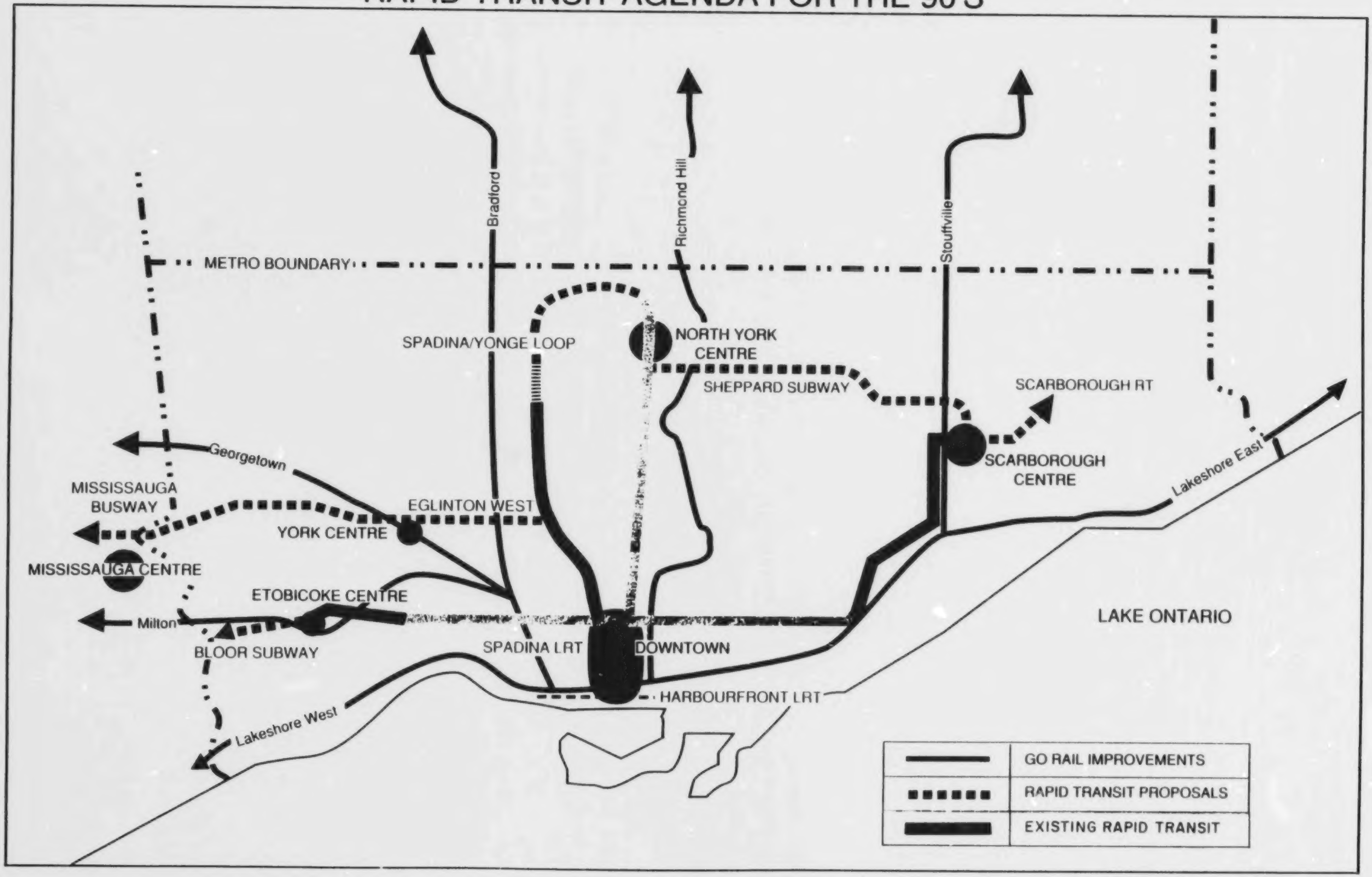
The findings of the North Metro Boundary Transportation Review are important components of the Rapid Transit Agenda for the 90s set out in the Provincial Governments document "Let's Move" - Transportation Solutions for the 90s. The Review recommendations will be refined further (e.g. corridor/alignment definition) in an environmental assessment as part of an implementation plan to be developed by the Transit Implementation Group established for this purpose by the Minister of Transportation.

b) **An Extension of the Spadina Subway northwesterly** towards the Bradford GO Transit line and the York University area, one of the opportunities for rapid transit network extension proposed in the "Transportation Directions" report of the MTO. This 1988 report indicated that the Province would assist the municipalities and the TTC to immediately undertake a joint review of this form of extension and it has now been consolidated into the Province's "Let's Move" 1990 initiative.

c) **A rapid transit facility on Sheppard Avenue** linked to a northerly extension of the Spadina subway to Sheppard Avenue. This represents the recommendation of the May 1985 Sheppard/Finch Rapid Transit Corridor Study, subsequently incorporated into the joint Metropolitan Toronto/Toronto Transit Commission's Network 2011 report.

Consideration of these reports during 1985 and 1986 culminated in approval by Metro Council, in June 1986, to implement a first phase of a Sheppard subway. The current positions of Metro Council and the Provincial Government on Sheppard Subway implementation were outlined in Chapter 1 of this document.

RAPID TRANSIT AGENDA FOR THE 90'S



Bradford
Richmond Hill
Stouffville
METRO BOUNDARY
SPADINA/YONGE LOOP
NORTH YORK CENTRE
SHEPPARD SUBWAY
SCARBOROUGH RT
SCARBOROUGH CENTRE
Georgetown
MISSISSAUGA BUSWAY
EGLINTON WEST
YORK CENTRE
MISSISSAUGA CENTRE
ETOBICOKE CENTRE
Milton
BLOOR SUBWAY
SPADINA LRT
DOWNTOWN
HARBOURFRONT LRT
Lakeshore West
Lakeshore East
LAKE ONTARIO
GO RAIL IMPROVEMENTS
RAPID TRANSIT PROPOSALS
EXISTING RAPID TRANSIT

LET'S MOVE

The Sheppard Subway, as described in the Final Report of the above Corridor study, is the recommended method of meeting the principal objectives of:

- supporting land use and development objectives, particularly at the North York and Scarborough City Centres;
- improving transit service speed, comfort and reliability within the corridor; and,
- reducing the increase in road traffic by attracting the growth in population and employment to the transit system.

The subway line is planned as an east-west rapid transit distributor along Sheppard Avenue. Initially it would extend from Allen Road, eastward across Yonge Street, Highway 404 and Victoria Park Avenue and then into Scarborough City Centre.

d) **A westerly extension of an east-west distributor corridor north of Highway 401 is,** a fourth more long term option. This would directly address the high degree of short distance trip making from Peel and York Regions into the outer areas of Metro and would also support the primary North York and Etobicoke centres.

Since the Network 2011 Report envisages the Allen Road/Sheppard Avenue intersection as the western extremity of the east-west distributor (Sheppard subway), a westerly extension could originate at this node. The North West Metro Transportation Study also noted that the Highway 27/Rexdale area has the potential to develop as a second major Etobicoke centre having a transit focus, served ultimately by a north-west rapid transit line.

4.9 Summary of Needs and Justification for the Proposed Undertaking

Population projections for the GTA to 2011 indicate significant rates of increase, particularly to York and Peel Regions. The corresponding distribution and magnitude of employment growth over this same period, as Section 4.3 has described, are such that trips between municipalities and cross-boundary trips in both directions between Metropolitan Toronto and these Regions, can be expected to grow substantially.

Rising levels of congestion experienced within and around Metropolitan Toronto have already emerged as major concerns to an economy which depends on an integrated system for moving people and goods efficiently and effectively. In the absence of improvements to the system, the congestion problem will become increasingly serious.

The development of "centres" and "sub-centres" to accommodate recent and projected future growth has been endorsed in policy terms as being desirable, both by Provincial and Metropolitan Toronto jurisdictions.

As indicated in previous sections of this assessment document, "centres" other than the Central Area of the City of Toronto have been successfully developed and will continue to experience growth, both within and beyond the boundaries of Metro Toronto. The need for improved transit service to promote these "centres" has also been recognized at policy levels.

Experience has shown that mature rapid transit networks help to reduce reliance on the automobile and act as a "backbone" for an integrated and unified multi-modal transportation system. An extensive network also provides high speed links between urban business/commercial centres and attracts commuters from surrounding regions

The stated provincial priority for rapid transit improvement is one which would see expansion of the network beyond the limits of this undertaking to improve accessibility to rapid transit for North Metro communities while also increasing the capacity of existing facilities. As well, opportunities to develop "gateways" for cross-boundary multi-modal travel are to be investigated. Certainly, growth projections affirm the likelihood of increased cross-boundary movement in this vicinity.

Metropolitan Toronto and City of North York policy priority is for expansion of rapid transit in an east-west direction along the Sheppard Avenue corridor. One of the aims of this expansion would be to foster further growth of North York's City "Center", which will be constrained in the absence of such a rapid transit line.

The proposed extension to the existing network will put in place the common link which allows maximum flexibility in responding to Metropolitan Toronto and surrounding Regions' future transportation requirements.

As previous sections have also indicated, the proposed undertaking represents an initial step towards reducing the projected severe congestion along the north-south arterials, by providing a rapid transit alternative to use of the automobile.

Extension of rapid transit from Wilson Station to the Sheppard Avenue/Allen Road intersection (the proposed undertaking) is essential to any future expansion options, northwesterly, "loop" and/or east-west system.

5.0 EVALUATION OF RAPID TRANSIT ALTERNATIVES TO THE UNDERTAKING

5.1. Approach

Consideration of two types of alternatives is required by the Environmental Assessment act: alternatives to the undertaking and alternative methods of carrying out the undertaking. The "do nothing" alternative must also be considered. Alternatives to the undertaking are functionally different ways of approaching and dealing with a problem or opportunity.

In this Section, rapid transit technology alternatives are evaluated for their ability to respond to problem solution, satisfaction of the need, and opportunities provided by a rapid transit undertaking.

Currently viable urban rapid transit technologies are:

- subway (heavy rail) - the undertaking
- light rail transit (LRT); and
- busways.

The sections which follow contain a general description of each of these alternatives as they would be applied in the primary and secondary study areas. An evaluation of the relative merits of the alternatives is then presented in matrix form.

5.2 Subway Expansion (The Undertaking)

The proposed undertaking, the subject of this Environmental Assessment consists of an extension of the Toronto Transit Commission's existing Spadina Subway line using the same heavy rail technology presently operated on the existing subway network. This comprises electrically driven six-car trains for which 1200 is the acceptable average number of passengers per train.

Depending on the frequency of service operated, the capacity of the subway extension could be between 10,000 and 35,000 peak hour passengers per direction.

The extension, which is a "common link" in the scenarios for subway network expansion in the North Metro region, would commence at the north end of the existing Wilson Station. The route envisaged is a dedicated fully grade separated right-of-way, generally in the Allen Road corridor extending to the vicinity of the Sheppard Avenue/Allen Road intersection. This right-of-way would comprise the most cost-effective combination of at-grade, open-cut and underground sections and would have a width between 10 and 16 metres depending on which section applied.

A station with associated surface facilities would be developed on the most appropriate quadrant of the Sheppard Avenue/Allen Road intersection. This facility would include a feeder bus loop, passenger pick-up and drop-off carousel and a park-and-ride lot. The infrastructure proposed also includes pocket tracks, tracks connecting the mainlines to the Wilson Yard and an interim terminal with a crossover and tail tracks at the new Sheppard/Allen station.

Maintenance and storage of the subway vehicles for the extension would be done at the existing Wilson Maintenance facility and storage yard north west of Wilson Station.

A more detailed description of the infrastructure for the undertaking is presented in Section 6.0.

5.3 Light Rail Transit

Light Rail Transit (LRT) is one of the proven technologies available for provision of rapid transit service in an urban environment. The LRT concept has emerged during the 1960's and 1970's as a method of upgrading aging streetcar systems to higher speed, more efficient services with modern vehicles.

Pursuit of this trend in North America led to the US Transportation Research Board Committee on Light Rail Transit adopting the concise definition of LRT as "a mode of urban transportation that uses predominantly reserved, but not necessarily grade-separated, rights-of-way. Electrically propelled vehicles operate singly or in trains providing a wide range of passenger capacities and performance characteristics at moderate costs."

For the purpose of this assessment of alternatives to the undertaking, an LRT service utilizing vehicles similar to the Articulated Light Rail Vehicle (ALRV) presently used by TTC, operating in a partially grade separated right-of-way has been adopted.

One of the purposes of the undertaking is to provide the common link from the existing TTC subway system to an expanded rapid transit network in North Metro. Consideration of LRT technology as an acceptable alternative for the link implies that it is also feasible for the subsequent expansion beyond the limits of this undertaking since investment in LRT technology for the 2 km link alone would not be cost-effective.

Implementing LRT in the Allen Corridor would require development of a dedicated right-of-way, approximately 12m in width extending from a suitable interchange location at Wilson Station northward to a station in the vicinity of the Sheppard Avenue/Allen Road intersection. Since there are no existing LRT lines or vehicle storage facilities in or near the study area, it would be necessary to develop a complete LRT maintenance facility before any LRT service could be operated.

Implementation of an LRT system would also require purchase of a fleet of vehicles with appropriate performance and operational characteristics as well as an inventory of spaces for ongoing maintenance.

In order to do the comparative evaluation of the LRT technology as an alternative to the undertaking, a functional alignment for LRT service was developed in the primary study area. The LRT right-of-way would commence on the east side of Wilson Station at an elevated station with turn-back facilities located above the existing commuter parking area. Covered access would be provided from this LRT station under the Allen Road northbound lanes and into the Wilson subway station complex to enable patrons to make the transfer from LRT to subway, or vice-versa.

From the elevated station, the LRT line would continue north on the east side of Allen Road on a short elevated section towards the existing Allen Road embankment slope. Along the embankment slope, the LRT lines would continue at grade (on the surface). This would require a retaining wall along the toe of the slope with a horizontal backfilled surface behind, thus eliminating the slope.

The at-grade section would be continued northward to the Transit Road/Allen Road intersection where it would be depressed to pass under Transit Road. An overhead crossing of Transit Road would also be feasible. North of Transit Road an at-grade right-of-way could be developed alongside Allen Road, with access to an LRT Maintenance Facility located on the property owned by Metro Toronto to the east.

An at-grade right-of-way could continue north, on Metro property, leading to a station in the southeast quadrant of the Sheppard Allen intersection. It is envisaged that the station would be in an open-cut or underground so that the alignment could pass under Sheppard Avenue and continue northwards. Facilities on the surface adjacent to the LRT station would include a feeder bus terminal, passenger pick-up/drop-off bays and limited parking for park-n-ride patrons using a mature LRT service serving areas to the north.

A realistic evaluation of the merits of switching to LRT technology for rapid transit expansion can only be done on the basis of commitment to a fairly extensive LRT system serving the secondary study area at least. Implementing a new technology only in the short primary study area corridor would not be effective hence assumptions as to the type of mature LRT system development beyond the study area have been made for evaluation purposes. These are that the LRT system would:

- operate in a partially separated right-of-way (i.e. some sections with mixed traffic and some at-grade crossings of minor roads)
- utilize ALRV type vehicles similar to those presently operated by TTC on streetcar lines in two-car trains.
- operate at headways which would provide a capacity of 15-20,000 peak hour passengers per direction.
- operate in corridors primarily at-grade but with some elevated or underground sections and grade separation at major road crossings. (ie. Sheppard Avenue)

5.4 Busways

The busway alternative evaluated later in this section of the report is considered to be a system of partially segregated rights-of-way. It is assumed to be of sufficient length to yield the benefits of rapid transit service and fulfil the role of a "backbone" to the entire transit network in the secondary study area.

The typical right-of-way width would be approximately 13 metres made up of two 4 metre lanes plus two 2.5 metre shoulders to accommodate disabled buses and provide snow storage. This width also permits buses making local stops to be over-taken by express buses. It is assumed that this right-of-way in an expanded North Metro system would be generally at grade but would also include open-cut, elevated or underground sections where necessary. A mix of full grade separation and at-grade signalized intersections with crossing streets is assumed.

The technology compared is envisaged as having the capability to accommodate corridor volumes ranging from the upper end of arterial street bus operation of 3000 passengers per hour per direction up to 12,000 in a totally dedicated primary rapid transit role. The busway is assumed to accommodate two types of service. Firstly, the primary service in which vehicles, usually articulated buses stop at every station on the busway and passenger access is by walk-in, feeder bus and park-n-ride. The second type of service would consist of express and limited stop bus routes that access the busway via special ramps at key locations providing a no-transfer ride for most of their users between the residential street system and major destinations.

In the 2 km length of the primary study area a possible busway corridor would comprise the following features. Busway service would commence at an elevated terminal station adjacent to the existing Wilson Station. This station, located above the existing parking lot would include a turn back loop as well as covered access under Allen Road into the subway station facilities to enable patrons to make the transfer from bus to subway, or vice versa.

From the station, the busway would continue northward on a short elevated structure until it reached the embankment of Allen Road northbound lanes. Along this embankment, an at-grade right-of-way would be developed by constructing a retaining wall at the toe of the slope and backfilling to form a two-lane roadway at the top of the wall. This roadway would continue parallel to Allen Road up to Sheppard Avenue. As it approached the Sheppard/Allen intersection, the busway would likely be depressed to allow an underground crossing of Sheppard Avenue. A station with associated support facilities such as feeder bus platforms, passenger pick-up and drop-off area and pedestrian access could be provided in the a quadrant of the intersection.

In the comparative evaluation it has been assumed that use of busway technology as an alternative to the undertaking implies development of an extensive network serving the secondary study area and surrounding regions. The infrastructure and operating characteristics would be such that peak hour passenger volumes in the 10-12,000 range could be carried.

5.5 The 'Do Nothing' Alternative

This alternative to proceeding with the undertaking implies reliance on the existing road infrastructure and existing transit services in the primary and secondary study areas as the means to meet the need highlighted in Section 4. A description of these existing transportation systems was provided in Section 3.4. It is these systems and their associated infrastructure which form the basis for this "Do Nothing" alternative. To provide an understanding of the rationale for the conclusions reached in the evaluation of this alternative, this section summarizes the present operating conditions on these systems and highlights their capability to respond to the need for greater mobility in the study area.

The major road link in the primary study area, Allen Road, is currently at Level of Service 'E' as a result of delays at intersections. This means there are significant delays, heavy congestion and frequent breakdowns in flow during the a.m. and p.m. peak periods. This link also carries 60 peak hour buses per direction in mixed traffic at intersections and on one exclusive bus lane in each direction. Intersection delays at Sheppard Avenue and Allen Road are typically one minute or more. High traffic volumes for major turning movements can make the delay even longer.

In the secondary study area there are several arterial roads that are operating at or near practical capacity. Examples of intersection delays measured in previous studies are Dufferin Street and Finch

Avenue where average delays were found to be in the order of 25 to 40 seconds per vehicle, and 60 seconds per vehicle at Dufferin Street and Steeles Avenue.

The average operating speed along the Dufferin Street/Allen Road corridor and parts of the east-west Sheppard Avenue is 16-19 km/h. Along Finch Avenue, traffic volumes have lowered the average speed to 23-28 km/h. These speeds reflect the deteriorating level of service as these arterial roads should ideally achieve operating speeds of 32-40 km/h. The Northwest Metro Transportation Study has also identified Steeles Avenue across the secondary study area as a problem corridor. Their analysis of 1978 and 1986 data indicated that the average vehicle operating speed on Steeles Avenue between Highway #27 and Yonge Street has dropped significantly from over 35 km/h to between 20 and 30 km/h depending on the section.

The above synopsis of present conditions highlights the consequences of relying on the existing road system to accommodate future needs given the projected growth in the travel demand through the area outlined in Section 4.

At present, in the secondary study area, only north-south bus routes on Dufferin Street and Allen Road benefit from reserved bus lanes. All east-west routes on Steeles, Finch and Sheppard Avenues must operate in mixed traffic. In addition, all transit routes are subject to the time delays of all signalized at-grade intersections in the area.

Over the past four years, TTC have found it necessary to add buses to the Finch Avenue West route peak hour service to maintain scheduled service on the increasingly congested arterials. Transit service in the area currently operates in the 18-21 km/h range. While this is close to the 19 km/h average speed for the TTC's surface transit systems, it must be recognized that this average is influenced by routes in the Central Area and older areas of the City where narrow road allowances restrict movement. Given the suburban nature of the secondary study area, the current operating speeds are lower than what is desirable to attract auto users.

It is Metro Toronto's stated policy that[1] wherever possible an increase of the transit modal split should be encouraged. This increase can only be achieved if travel by transit is seen to be faster, more convenient and more reliable than the automobile mode. The ability of this present transit service, continued unchanged, to achieve that desired modal split increase, forms the basis of the evaluation of the "do nothing" alternative from a transit perspective.

5.6 Evaluation of the Alternatives

Again, the Ontario Ministry of Environment Guidelines provide useful comment with respect to the evaluative process:

"The concept of need is subjective and its definition may vary depending on the perspective of the participant. The Proponent is expected to address "need from its own perspective...**The proponent addresses "need" in evaluating the advantages and disadvantages of alternatives.** The results of the evaluation process serve to clarify, quantify and justify the perceived need."(p.29).

> "**The comparison of the undertaking to the do nothing alternative is a key aspect of demonstrating the "need" for the undertaking.** This provides the basis for determining that the advantages of proceeding with the undertaking outweigh the disadvantages to the proponent and the people of the Province." (p.29).

As noted in Section 4, a statement of "need" from the proponent's perspective has been developed:

Utilizing this statement, a series of criteria were developed in conjunction with the Technical Working Committee, to evaluate the advantages and disadvantages of the viable alternatives and the Undertaking and their ability to meet the defined need. These criteria are defined below:

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[1] Metropolitan Toronto, Official Plan for the Urban Structure (September, 1981) Section 6.

1. **Reliability of service**: Measure of the efficiency of the rapid transit option.

2. **Ability to maintain or improve present trip time**: Measure of the performance of the rapid transit option.

3. **Convenience**: Measure of the ease and comfort of the option to users.

4. **Safety and security**: Measure of the ability to minimize potential for accidents, injury and criminal activity.

5. **Impact on built environment**: Measure of the disruption to existing land uses and communities.

6. **Pollution**: Measure of the extent to which the option is environmentally sound.

7. **Extent of reduction of reliance on the automobile**: Extent to which the option reduces automobile use.

8. **Ability to respond to future growth:** Measure of the flexibility of the option to accommodate system expansion.

9. **Contribution to achievement of policy objectives**: Measure of the extent to which the option responds to the stated aims of provincial, Metropolitan Toronto and City of North York jurisdictions.

10. **Cost:** Measure of the magnitude of investment required.

Table 5-1, the matrix which follows, presents the findings of the evaluation of each of the alternatives and the proposed Undertaking against the ten criteria.

5.7 The Preferred Alternative

While the other technologies meet several of the criteria in varying degrees, it is evident from perusal of the preceding evaluation that the proposed Undertaking, Subway expansion, is the technology best able to accomplish the need for rapid transit network expansion to improve mobility and meet future travel needs. As the summary statements in Table 5-1 note, **the Undertaking:**

- is generally reliable;
- has considerable ability to improve or maintain trip time;
- maximizes convenience of the rapid transit alternative;
- provides high levels of safety and security;
- is highly flexible to accommodate system expansion;
- has high potential to attract auto users to rapid transit;
- minimizes disruption, by it being almost fully separated from the built environment;
- is environmentally sound;
- is highly compatible with policy objectives; and
- is cost effective over the life of the Undertaking.

TABLE 5-1
EVALUATION OF ALTERNATIVES TO THE UNDERTAKING

Subway Expansion	LRT	Busways	Do Nothing
RELIABILITY: Measure of efficiency of rapid transit option.			
- Use of totally separate right-of-way ensures no traffic congestion delays. - Technology minimizes delays due to inclement weather. - Frequent service with good on-time performance record minimizes wait time.	- Technology usually implies some interface with traffic; hence potential for delays from congestion or accidents. - Some risk of weather related delays in mixed traffic sections. - Reliability depends on efficiency of connection to subway at Wilson Station. - Technology can achieve good on-time performance record in sections with separated right-of-way.	- Buses in separate right-of-way can achieve good reliability; combined busway and local route operation could reduce reliability. - More prone to climate-caused delays than rail technologies. - Technology usually implies some interface with traffic - Potential for schedule variations, equipment malfunctions, accident delays is greater since busway requires more vehicles. - Loading/unloading difficulties can reduce schedule reliability. - Depends on reliability/efficiency of connection to subway at Wilson Station.	- Existing levels of service on arterial roads are so low that reliability of traffic flow cannot be assured. - Existing road system cannot accommodate projected traffic volumes at reasonable operating speed. - Capacity is further reduced by weather related delays. - Regular peak-hour congestion and accident delays on the downstream corridors (e.g. 401 and Allen Expressway will reduce reliability for travellers through the study area, and to outlying areas.
Option is generally reliable.	Inherent reliability can be reduced by external factors.	Reliability not totally assured.	Option does not assure reliability.

TABLE 5-1
EVALUATION OF ALTERNATIVES TO THE UNDERTAKING

Subway Expansion	LRT	Busways	Do Nothing
ABILITY TO MAINTAIN OR IMPROVE TRIP TIMES: Measure of performance efficiency of the rapid transit option.			
- Greater portion of journey on subway will improve present bus/subway trip times. - Growing congestion on road system has a reduced effect on journey time if subway portion of total trip is increased. - Segregated ROW allows higher operating speed typically in 30-35 km/h range. - Segregated ROW permits constant or improved trip times independent of demand until technology nears capacity.	- Trip time advantage of LRT over bus or auto partially lost by need for extra transfer (bus or auto to LRT to subway). - Growing congestion on road system has a reduced effect on journey time if some local bus or auto travel is replaced by LRT. - Partially segregated right-of-way allows higher operating speeds than congested road system, typically in 20-30 km/h range. - Partial segregation of ROW will permit constant or improved trip times independent of demand until technology nears capacity. - Additional terminal operation could result in delays.	- Replacement of local street travel with segregated ROW will improve present local bus to subway trip times. - Trip time advantage of busway over local bus or auto is partially lost by need for extra transfer to access subway. - Allowing local bus routes to access busway avoids time lost in LRT option. - Possible traffic congestion at access points to busway could increase trip times.	- Projected increased travel demand on arterials in north Metro and surrounding area will make it difficult to maintain present auto trip times. - Average speeds on arterials are currently below desirable operating speed and will decline as volumes increase over time. - Existing congestion and projected traffic growth will cause increase in local bus trip times.
Option has considerable ability to improve or maintain trip time.	**Option has ability to improve or maintain trip times.**	**Option could offer moderate trip time improvements over short term.**	**Option will cause increased trip times.**

TABLE 5-1
EVALUATION OF ALTERNATIVES TO THE UNDERTAKING

Subway Expansion	LRT	Busways	Do Nothing
CONVENIENCE: Measure of the ease and comfort of the option to users.			
- Requires only one transfer from bus or auto to access existing subway network. - Longer portion of bus/subway journey occurs at higher speed with improved ride comfort. - Frequent subway service ensures rapid transfers from feeder bus. - Fewer transfers reduces exposure to inclement weather. - Continuity from expansion of existing subway network is an attractive alternative to auto mode and bus mode. - Less stressful and more relaxing because of fewer transfers.	- Requires transfer from bus or auto to LRT and then additional transfer to subway. - More exposure to inclement weather discomfort during transfers. - Less attractive to auto users due to transfers involved. - Greater user stress from need to make transfers and potential traffic delays from interference.	- Busway to subway transfer equivalent to feeder bus to subway transfer. - Less comfort on linehaul buses; poorer ride quality than rail options. - Frequencies on busway dictated by service on local routes. - More flexibility to plan route to respond to ridership demand. - Reaches maximum carrying capacity sooner than other RT modes, reducing comfort and convenience of ridership. - Perception of bus mode makes attraction of auto users to busway difficult.	- Private auto is more convenient than other modes during journey since no transfers are required and auto ensures privacy. - Auto use protects travellers from inclement weather. - Auto use in congested existing arterials results in increased stress and frustration during journey, offsetting benefits of comfort and privacy. - Growing lack of affordable parking and remoteness from destination reduces convenience of auto. - Road congestion will cause deterioration in convenience of local bus service as trip times increase.
Maximizes convenience of rapid transit alternative.	**Option offers moderate ride comfort but convenience reduced by multiple transfers.**	**Inherently less comfort than rail options with convenience reduced as system reaches capacity.**	**Option remains the most convenient although benefits could be lost over time.**

TABLE 5-1
EVALUATION OF ALTERNATIVES TO THE UNDERTAKING

Subway Expansion	LRT	Busways	Do Nothing
SAFETY AND SECURITY: Measure of ability to minimize potential for accidents, injury and criminal activity.			
- Design and operational standards aimed at high levels of safety and security; - Separate fenced ROW reduces potential for accidents by eliminating interface with other modes. - Minimum potential for accidents caused by inclement weather. - Monitored subway facilities offer secure environment. - Fenced ROW and manned stations reduces potential for vandalism, mischief, etc.	- Design and operational standards aimed at high levels of safety and security; - Partially separated ROW reduces potential for accidents by minimizing interface with auto modes. - Some potential for accidents at level crossings or areas of mixed traffic. - Low potential for accidents caused by inclement weather. - Monitoring of some LRT facilities increases security. - More opportunity for vandalism, mischief, etc. on partially secure ROW.	- Partially separate ROW reduces potential for accidents by minimizing interface with auto mode. - Option is vulnerable to weather-related accidents. - ROW less protected hence open to vandalism.	- Accident potential will persist as traffic volume on existing roads increases. High speed accidents could be reduced but minor accident frequency will likely increase. - Auto mode is vulnerable to weather-related accidents. - Auto users are generally secure during journey.
Option provides high levels of safety and security.	**Option provides good level of safety and security.**	**Option provides fair level of safety and security but does not minimize risk in all areas.**	**Security is generally ensured but option does not minimize potential for accidents.**

TABLE 5-1
EVALUATION OF ALTERNATIVES TO THE UNDERTAKING

Subway Expansion	LRT	Busways	Do Nothing
ABILITY TO RESPOND TO FUTURE GROWTH IN TRAVEL DEMAND: Measure of the flexibility of the option to accommodate system expansion.			
- Subway represents the most effective common "link" to all other possible subway expansion initiatives under consideration. - Subway option provides most residual capacity to meet future growth in ridership. - Subway option offers opportunity *to link Yonge and Spadina lines* providing more capacity for trips to and from central core. - Expansion of existing subway provides convenient access from present network to growth areas within and beyond Metro. - Ability to respond to recognized potential network expansion needs in a variety of directions. - Option is identical to existing rapid transit infrastructure in the Spadina corridor.	- LRT option implies development of a more extensive LRT network in future. - LRT provides lower residual capacity to meet future growth in ridership. - Eliminates opportunity for link of Yonge-Spadina lines to gain more capacity for central core trips. - LRT option has some potential to fulfil rapid transit network roles. - LRT offers more flexibility in alignment planning for subsequent expansion and the ability to gradually lengthen trains. - Technology change at Wilson station not desirable in view of potential for an E-W to N-S transfer at Sheppard Avenue.	- Busway provides low residual capacity to meet future ridership growth. - Eliminates opportunity to gain rapid transit network capacity from link of Yonge and Spadina subway lines. - Busway offers greater route planning and implementation flexibility. - More flexibility to vary headways to match demand	- The projected long term growth in travel demand will worsen the already poor levels of service on the arterial roads and through existing intersections. - Increased congestion will also reduce the efficiency and reliability of the existing transit service. - Delays and longer trip times will reduce the attractiveness of transit resulting in a further reduction of the modal split.
Option is highly flexible to accommodate system expansion.	**While technically able to provide flexibility, option is not the most efficient or cost-effective in the system context.**	**Option is not able to respond efficiently to future growth due, primarily, to low residual capacity for growth in demand.**	**Option represents an obstacle to future growth in mobility needs.**

TABLE 5-1
EVALUATION OF ALTERNATIVES TO THE UNDERTAKING

Subway Expansion	LRT	Busways	Do Nothing
EXTENT OF REDUCTION OF RELIANCE ON THE AUTOMOBILE: Extent to which the option reduces auto-mobile use.			
- Subway network expansion can be marketed as a faster, more convenient alternative to road congestion. - Option provides a reliable alternative to car-ownership. - Expanded extensive subway network with park-n-ride facilities can attract commuters currently relying on auto option.	- Network expansion by switching from subway to LRT is less marketable as a faster, convenient alternative to auto-use. - Provides an alternative to car ownership. - Possible need for multiple transfers (car-LRT-subway) and discomfort during bad weather could discourage auto users from switching to transit. - Expanded rapid transit network with park-n-ride facilties has potential to attract commuters currently relying on auto option.	- Busway development offers an alternative to auto use in short term. - Provides an alternative to car ownership. - Possible need for multiple transfers (car-busway-subway) and susceptibility to weather delays could discourage auto users from switching to busways. - Expanded rapid transit network with park-n-ride facilities has potential to attract commuters currently relying on auto option.	- Lack of an efficient, extensive alternative (e.g. rapid transit network expansion) will increase reliance on the automobile. - Impact of road traffic congestion on the reliability of existing transit routes will encourage travellers to rely on the automobile. - Does not provide an attractive alternative to car ownership.
Has high potential to attract auto users to rapid transit.	**Has moderate potential to attract auto users to rapid transit.**	**Has moderate potential to attract auto users to rapid transit.**	**Doing nothing to the road or rapid transit systems offers little or no potential to attract auto users to rapid transit.**

TABLE 5-1
EVALUATION OF ALTERNATIVES TO THE UNDERTAKING

Subway Expansion	LRT	Busways	Do Nothing
IMPACT ON BUILT ENVIRONMENT: Measure of the disruption to existing land uses and communities.			
- Option, being generally within existing transportation corridors and/or underground, reduces the likelihood of a "barrier effect". - Option can be largely accommodated in existing linear transportation systems, thereby minimizing disruption to property. - Opportunity costs associated with consumption of land for transportation corridors is minimized.	- Option, being in mixed traffic corridors and/or mostly above ground, could create some barrier effect in communities. - Option can be largely accommodated in existing linear transportation systems, thereby minimizing disruption to property. - Opportunity cost associated with consumption of land for transportation corridors is minimized. - Signal priority at level crossings has an impact on traffic flow. - Need for immediate dedicated maintenance facility involves land consumption.	- Option, being in mixed traffic corridors and/or mostly above ground, could create some barrier effect in communities. - Option can be largely accommodated in existing linear transportation systems, thereby minimizing disruption to property. - Need for dedicated maintenance facilities involves land consumption. - Opportunity cost associated with consumption of land for transportation corridors is minimized. - Signal priority at road intersections not grade separated with busway could impact traffic flow.	- Increasing levels of congestion will: i) affect access to and from residential, commercial and institutional areas and places of work; ii) induce diversion of traffic from arterials to residential street; iii) induce parking on residential areas; iv) limit accessibility of emergency services to neighbourhoods; v) reduce ability to redevelop land in the secondary study area.
Option minimizes disruption, by it being almost fully separated from built environment.	**Option can cause minor disruption since it is not entirely separated from built environment.**	**Option can cause minor disruption since it is not entirely separated from built environment.**	**Option causes no physical impact on built environment but could disrupt mobility.**

TABLE 5-1
EVALUATION OF ALTERNATIVES TO THE UNDERTAKING

Subway Expansion	LRT	Busways	Do Nothing
POLLUTION: Measure of the extent to which the option is environmentally sound.			
- Assuming present day subway technology and mitigative measures, underground portions of the system attenuate noise and vibration to acceptable MOE guidelines, while at-grade portions are more difficult to attenuate and require greater separation. - Bus terminal operations are a source of emissions, which could affect air quality. - Segregation (underground, open cuts and berms) implies less visual intrusion; fenced surface sections involve some visual impact. - Low salt pollution; only parking lot de-icing. - Subway is most efficient with regard to energy consumption per passenger. - Subway is most likely to reduce reliance on the automobile, thereby reducing emissions.	- Vibration impact can be reduced by aligning track away from sensitive areas or by mitigative measures. - Partial segregation makes noise reduction to acceptable levels more difficult. - Partial segregation and infrastructure at LRT subway interchange implies some visual intrusion. - Some visual impact results from overhead traction power lines. - Low salt pollution: only parking lot de-icing. - Elec. LRT technology reduces impact to feeder bus interface at terminal station. - Bus terminal operations are source of emissions, which could affect air quality.	- Infrastructure required for system expansion and busway-subway interchange could adversely affect urban vistas and streetscapes. - Bus terminal operations generate emissions, which could affect air quality. - Development of alternative fuel buses (e.g. natural gas) has potential to reduce busway air quality concerns. - Noise levels generated by high volume bus traffic may be objectionable in urban settings. - Option causes salt pollution from need to de-ice busway.	- Option will produce increasing congestion and compound existing emissions problems. - Noise levels generated by high volume automobile corridors and congested conditions are objectionable and already exceed MOE guidelines at points measured along Allen Road. - Option causes environmental salt pollution from need to de-ice roads.
Option is environmentally sound.	Option generates some environmental effects (noise, visual).	Option generates several environmental effects (noise, air, visual and salt).	Option does not respond to the need for an environmentally sound system (noise, air, visual, salt).

TABLE 5-1
EVALUATION OF ALTERNATIVES TO THE UNDERTAKING

Subway Expansion	LRT	Busways	Do Nothing
CONTRIBUTION TO ACHIEVEMENT OF POLICY OBJECTIVES: Measure of the extent to which the option responds to the stated aims of provincial, Metropolitan Toronto and City of North York jurisdictions.			
- Option is consistent with Provincial policy which identifies need for rapid transit to promote a balanced transportation system and with recent provincial government announcement of its intent to complete Yonge Street-Spadina subway loop system. - Option is consistent with Metropolitan Toronto endorsement of the recent Provincial announcements and City of North York policies which recognize the need for rapid transit to relieve congestion. - Option is able to provide the common "link" which is essential to future subway expansion plans.	- Option is consistent with Provincial - Metropolitan Toronto and City of North York policies which identify need for rapid transit. - LRT network expansion is inconsistent with the recent provincial government announcement (endorsed by Metropolitan Toronto) of its intent to complete Yonge Street-Spadina subway loop system.	- Option is consistent with provincial policy which identifies need for transit, but balancing investment between roads and transit is better met by rapid transit options with more residual capacity. - Busway network expansion in this corridor is inconsistent with Provincial policy to complete Yonge Street-Spadina subway loop system.	- To do nothing is in conflict with provincial, Metropolitan Toronto and City of North York policies, all of which call for improvements to the existing rapid transit system in this corridor.
Option is highly compatible with policy objectives.	**Option is less compatible with policy objectives.**	**Option is not as responsive to policy objectives as specified other alternatives.**	**Option undermines policy objectives.**
COST: Measure of the magnitude of investment required.			
- Typical capital costs are in order of $60 million/km. - Operating costs are in the $13-$17 million range annually.	- Typical capital costs are in order of $40 million/km. - Operating costs are in the $24-30 million range annually.	- Typical capital costs are in order of $25-30 million/km. - Operating costs are in the $22-27 million range annually.	- Results in significant indirect costs from loss of efficiency in transportation of people and goods.

* Operating costs are estimated for a typical 8km long extension carrying 15-20,000 peak hour passengers per direction.

As indicated in Section 4, the proposed undertaking (Spadina subway extension) is the common element of a series of subway network expansion initiatives currently being supported by all levels of government. The evaluation confirms that the use of subway technology in this context offers an attractive, convenient reliable, high speed rapid, transit solution to the need for a balanced transportation system.

In Section 6, alternative methods of carrying out the Undertaking are described.

6.0 ALIGNMENT AND STATION ALTERNATIVES

6.1 Description of Alternatives

The starting point for examining alignment alternatives was a review of the reports of previous studies and initiatives related to the undertaking. This, together with discussions with TTC Staff and the Technical Working Committee resulted in the development of eight alternatives. These alternatives, considered worthy of feasibility design and subsequent evaluation comprise:

- Six alternatives which require passengers to transfer between an extended Spadina line and a possible Sheppard subway line by changing trains at a Sheppard Avenue/Allen Road station, i.e. alternatives A-1 to A-6 and;

- Two alternatives, B1 and B2 which through integration of service, permit movement from one line to another on the same train.

A description of the individual alternatives follows:

6.1.1 Alignment Alternative 'A-1' (shown in Exhibit 6.1.1)

This alignment, 2240 metres in length, extends from the north end of the Wilson Station platforms and follows the existing double tracks which cross under the southbound lanes of Allen Road and enter the Wilson Yard. Within the yard, the alignment utilizes the existing, at-grade mainline tracks on the east side which would be extended to the north end of the Wilson Yard property. From this point, new mainlines would continue northwards in open-cut towards Downsview Airport's east-west runway #09-27. South of the runway, the alignment enters an underground section at shallow depth in order to pass under the runway strip, straddling the runway. Discussions with DND and Boeing Canada have verified that the most economical for shallow underground subway the cut-and-cover method of construction, is feasible for this underground section. From the north edge of the runway strip, the tracks are again in open-cut for approximately 200 metres. The alignment then continues underground curving to the east into the Allen Road right-of-way. The alignment remains in the right-of-way through the station which, if Allen Road and Sheppard Avenue are not grade separated, could be directly under the intersection. However, if grade separation is to be accommodated, the station would have to be depressed a further 7 metres.

Simultaneous construction of a grade separation would allow consideration of a depressed station in the Allen Road median. This integration would have a significant impact on the grade separation design and construction costs.

From the station the Spadina line would be extended northward up Allen Road in cut and cover curving gradually from the road right-of-way to the strip of public property on the east side of Allen Road.

In this alternative, a "cross-station" configuration, centred on the intersection is envisaged, with surface bus terminal facilities, passenger pick-up/drop-off access and parking located in the south-east quadrant on property currently owned by Metro. The "cross" arrangement results from the intersection of the Spadina line extension and a possible Sheppard line passing under the Spadina line in an east-west direction slightly south of Sheppard Avenue.

Characteristics of Alignment A-1

Overall Length (including 200 metre trail track north of Sheppard/Allen station)	:	2240	metres
Length on surface	:	900	metres
Length in open-cut	:	510	metres
Length underground	:	830	metres
Min. radius of curvature	:	two 300 metre curves	
Max. grade required (and length of max. grade)	:	3 % over 200	metres

Length of existing track incorporated into alignment	:	650	metres
Distance the alignment extends north of centre-line of Sheppard Avenue	:	220	metres
Type of Station (as described in Section 6.2)	:	Cross station with surface facilities in South-east quadrant.	

6.1.2 Alignment Alternative 'A-2' (shown in Exhibit 6.1.2)

From the north end of the Wilson Station platforms, Alternative 'A-2' also makes use of the existing double tracks under Allen Road and through Wilson Yard, new construction beginning at the northeast corner of the yard. In this alternative, the mainline continues north in open-cut to the south edge of the east-west runway zone where it would be taken underground to cross the runway zone at shallow depth in a box section constructed by the cut-and-cover method.

North of the runway, after a further 230 metres in open-cut, the alignment curves slightly east and passes under Allen Road in a skew crossing about 100 metres long, to reach the southeast quadrant of the Sheppard Avenue/Allen Road intersection. The crossing of Allen Road is possible by cut-and-cover construction using decking or temporary detours of the traffic lanes, the method considered to be the most economical for this situation. From this point, to an underground station in the southeast corner of the intersection, the line continues underground for approximately 200 metres.

Again, a "cross-station" configuration is envisaged, with platforms and all terminal facilities on Metro-owned property in the southeast quadrant. The platforms would extend under Sheppard Avenue and 200 metre long tail tracks would be constructed under the vacant strip of road allowance between Allen Road and Dufferin Street north of Sheppard Avenue.

The Sheppard line would pass under the Spadina station on an east-west alignment, slightly south of the Sheppard Avenue/Allen Road intersection. Extension of the Spadina line northwards could also be achieved by continuing in the strip of public land on the east side of Allen Road.

Characteristics of Alignment A-2

Overall Length (including 200 metre trail track north of Sheppard/Allen station)	:	2205 metres
Length on surface	:	900 metres
Length in open-cut	:	510 metres
Length underground	:	795 metres
Min. radius of curvature	:	one 300 metre curve
Max. grade required (and length of max. grade)	:	1.6 % over 170 metres
Length of existing track incorporated into alignment	:	650 metres
Distance the alignment extends north of centre-line of Sheppard Avenue	:	230 metres
Type of Station (as described in Section 6.2)	:	Cross-station with all facilities in South-east quadrant.

6.1.3 Alignment Alternative 'A-3' (shown in Exhibit 6.1.3)

The objective in developing alternative 'A-3' was to investigate the merits of an alignment which remained west of Allen Road for the entire 2360 metre length of the extension with a station located in the northwest quadrant of the Sheppard Avenue/Allen Road intersection. Consequently, this alternative follows the existing double tracks through Wilson Yard, to the north yard limit. At this point, the alignment curves slightly to the northwest in an open-cut across airport property, up to the runway zone. After passing under the runway in a shallow underground section, the mainline curves back to the north passing the Department of National Defence (DND) explosive storage facility beyond the fenced restricted zone. In this area, the subway would be underground at a safe distance from the DND installation. DND have also confirmed that the storage facility will be converted to a "total containment" status by 1993 alleviating the need for restricted zones around the installation. (DND letter dated June 15, 1990 in Appendix 6.1).

Remaining on the west side, the alignment passes under Sheppard Avenue, entering an underground "cross station" with surface terminal facilities in the northwest quadrant of the intersection. The station and terminal facilities would be located on vacant privately owned land fronting onto Allen Road and Sheppard Avenue.

From the station, extension of the Spadina line to the north of Sheppard Avenue would continue underground crossing under Allen Road into the public strip of land on the east side between Allen Road and Dufferin Street. This alignment would require a minor easement across privately-owned land immediately north of the station site.

A possible Sheppard subway, from the east would pass under the Spadina line, slightly north of Sheppard Avenue, on the east-west axis of the cross-station.
It could be continued west, either across airport lands or by curving north-west back onto the Sheppard Avenue right-of-way.

Characteristics of Alignment A-3

Overall Length (including 200 metre trail track north of Sheppard/Allen station)	:	2360	metres
Length on surface	:	900	metres
Length in open-cut	:	320	metres
Length underground	:	1140	metres
Min. radius of curvature	:	one 300	metre curve
Max. grade required (and length of max. grade)	:	1.6 % over 170	metres
Length of existing track incorporated into alignment	:	650	metres
Distance the alignment extends north of centre-line of Sheppard Avenue	:	330	metres
Type of Station (as described in Section 6.2)	:	Cross Station with all faciliites in North-west quadrant.	

6.1.4 Alignment Alternative 'A-4' (shown in Exhibit 6.1.6.)

This alternative reflects the characteristics of an alignment commencing at the north end of the existing Wilson Station platforms in the median of Allen Road and reaching Sheppard Avenue without utilizing the existing tracks on the east side of the Wilson yard. Where the existing mainlines become yard access tracks swinging west and under the southbound Allen Road lanes, the 'A-4' alignment would continue north in the median. In order to maintain a connection to Wilson Yard to take trains in and out of service, the north and southbound mainlines would have to be separated vertically in this area. This separation would allow a single track from the yard to pass under the southbound mainline into a pocket track linked to both mainlines. While this connection is feasible, it would require complex, costly construction techniques and staging to implement without disrupting present subway service and access to Wilson Yard.

To cross the northbound lanes of Allen Road and the Transit Road intersection, the alignment would be depressed in the median with a cut-and-cover, underground section under the existing road system. This would bring the tracks onto the east side of Allen Road, north of Transit Road. Continuing north, the mainlines would follow the curvature of Allen Road, in open-cut on the east side, swinging into a north-south direction in the southeast corner of the Sheppard Avenue/Allen Road intersection.

The station at Sheppard Avenue would be an underground "cross-station" with the north end of the platforms under Sheppard Avenue. Any future extension of the Spadina Line would again follow the strip of public land east of Allen Road. A possible Sheppard subway alignment would pass under this Spadina alignment slightly south of Sheppard Avenue. Station surface facilities would be configured in a similar way to Alternative 'A-2' in the southeast quadrant of the intersection. The layout of all terminal facilities and the Spadina line alignment itself would permit implementation of a Sheppard Avenue/Allen Road grade separation at any time in the future.

In addition to the mainlines previously described, this alternative requires separate double track service connections from Wilson Yard. The service tracks, to bring trains into and out of service would link the north end of the yard to the mainlines by crossing under Allen Road opposite the end of the east-west runway. The tracks would be in open-cut for approximately 250 metres and cross Allen Road in a box section constructed most economically by the cut-and-cover method with decking or detours.

Characteristics of Alignment A-4

Overall Length (including 200 metre trail track north of Sheppard/Allen station)	:	2230	metres
Length on surface	:	-	metres
Length in open-cut	:	1380	metres
Length underground	:	850	metres
Min. radius of curvature	:	one 300	metre curve
Max. grade required (and length of max. grade) metres	:	3 % over 300	
Length of existing track incorporated into alignment	:	-	metres
Distance the alignment extends north of centre-line of Sheppard Avenue	:	230	metres
Type of Station (as described in Section 6.2)	:	Cross-station with all facilities in South-east quadrant.	

6.1.5 Alignment Alternative 'A-5' (shown in Exhibit 6.1.5)

Once again, this alternative utilizes the existing easternmost track within the Wilson Yard, with the extension commencing at the northeast corner of the yard. The new alignment curves immediately to the east and heads towards Allen Road in an open-cut across the Department of National Defence property. It passes under Allen Road in a box section, constructed at lowest cost by the cut and cover method, opposite the end of the east-west runway. The alignment then continues on the east side of the road in open-cut on Metro-owned property.

The alignment must follow a tight curve to the northwest to remain close the east edge of the Allen Road right-of-way. This is necessary to avoid impact on Metro property earmarked for a possible future yard and shops complex east of Allen Road. Approximately 400 metres south of Sheppard Avenue, the mainlines would be depressed to enter an underground station with a "cross-station" configuration in the southeast quadrant of the Sheppard Avenue/Allen Road intersections. Surface facilities would again occupy Metro land in this quadrant.

A future extension of the Spadina line further north would follow the east side of Allen Road, utilizing the strip of public land between Allen Road and Dufferin Street. An east-west Sheppard subway line could again pass under the "cross-station" slightly south of Sheppard Avenue, and in the longer term could continue westward under Sheppard Avenue or across airport lands.

Characteristics of Alignment A-5

Overall Length (including 200 metre trail track north of Sheppard/Allen station)	:	2220	metres
Length on surface	:	775	metres
Length in open-cut	:	700	metres
Length underground	:	745	metres
Min. radius of curvature	:	three 300 metre curves	
Max. grade required (and length of max. grade)	:	1.6 % over 170	metres
Length of existing track incorporated into alignment	:	650	metres
Distance the alignment extends north of centre-line of Sheppard Avenue	: :	330	metres
Type of Station (as described in Section 6.2)	:	Cross-station all facilities in South-east quadrant.	

6.1.6 Alignment Alternative 'A-6' (shown in Exhibit 6.1.6.)

The objective of this alternative is to maximize the use of the Allen Road right-of-way and present the approach of continuing with the subway in an expressway median as adopted for the existing Spadina line, south of Wilson station.

Commencing at the north end of the Wilson station platforms, this alignment follows the Allen Road median to the point where the existing northbound expressway lanes converge south of the Transit Road intersection. Through this section it would be necessary to regrade the existing double tracks leading to Wilson Yard, separating the north and southbound tracks vertically to allow a single track from the yard to pass under the southbound mainline into a pocket track linked to both mainlines.

From 500 metres north of Wilson Station to Sheppard Avenue, Allen Road would have to be reconstructed with a divided expressway cross-section to provide a median corridor for the subway extension. The subway would also have to pass under or over the Transit Road intersection unless Transit Road was grade separated from Allen Road.

At the Sheppard Avenue intersection the median of Allen Road would have to be widened considerably to accommodate a three-platform Sheppard/Allen station. Grade separation of Sheppard Avenue and Allen Road is also a requirement.

The station, in the median of a depressed Allen Road, would be connected to the Metro-owned southeast quadrant property by an overhead walkway from a mezzanine level above the platforms. A bust terminal, passenger pick-up and drop-off facility and a park-n-ride lot would all be provided on the Metro property with access from Sheppard Avenue.

A possible east-west Sheppard line could be aligned slightly south of Sheppard Avenue, passing under the Spadina Station resulting again in a "cross-station" configuration in the median.

Characteristics of Alignment A-6

Overall Length (including 200 metre trail track north of Sheppard/Allen station)	:	2240	metres
Length on surface	:	470	metres
Length in open-cut	:	1720	metres
Length underground	:	50	metres
Min. radius of curvature	:	one 300	metre curve
Max. grade required (and length of max. grade)	:	2.3 to 3% over 750 metres	
Length of existing track incorporated into alignment	:	-	metres

Distance the alignment extends north of centre-line of Sheppard Avenue	:	210 metres
Type of Station (as described in Section 6.2)	:	Cross-station with surface facilities in South-east quadrant.

6.1.7 Alignment Alternative 'B-1' (shown in Exhibit 6.1.7)

This alignment, the first of two which permit service integration, also utilizes existing tracks from Wilson Station through the east side of the Wilson Yard to its northeast corner. From this point, new mainlines would swing to the northwest, in open-cut, pass under the airport runways and taxiway and then loop back onto an east-west alignment parallel to Sheppard Avenue. The 1 km section under the airport property would have to be constructed using tunnelling methods. After passing under Allen Road, south of the Sheppard Avenue intersection, the line would enter an underground station in the southeast quadrant on Metro-owned land earmarked for transit use. The station platforms, in an east-west orientation, would be located immediately below the bus terminal with access from Sheppard Avenue for buses, passenger pick-up and drop-off and park-n-ride patrons.

Future extension of the line to the east, as a Sheppard line, could be achieved by extending the terminal tracks at the Sheppard/Allen Station in a curve onto the centre line of the Sheppard Avenue right-of-way and continuing east under the road. To extend a Sheppard line to the west from the station, the east-west tracks would have to swing to the north, immediately after passing under Allen Road and then continue north to join the Sheppard Avenue right-of-way which could form a corridor to the west.

Extension of the Spadina line to the north is more difficult requiring a tight curve northward from Sheppard Avenue west of the Wilson Heights Boulevard/Sheppard Avenue intersection. This curve, would take the alignment onto Wilson Heights Boulevard. It would then proceed north under the Boulevard to join the Allen Road right-of-way further north.

The phasing of construction of these extensions is complex as provision must be made in the first phase to achieve the desirable ultimate configuration at the station i.e. the two Spadina line tracks positioned vertically above the tracks of a possible Sheppard line or vice versa.

Characteristics of Alignment B-1

Overall Length (including 200 metre trail track north of Sheppard/Allen station) : 2860 metres

Length on surface : 900 metres

Length in open-cut : 440 metres

Length underground : 1520 metres

Min. radius of curvature : 300 metre curves (over 1200 metres)

Max. grade required (and length of max. grade) : 1.6 % over 170 metres

Length of existing track incorporated into alignment : 650 metres

Distance the alignment extends north of centre-line : (alignment terminates south of Sheppard Avenue)

Type of Station (as described in Section 6.2) : Parallel station with all facilities in South-east quadrant

6.1.8 Alignment Alternative 'B-2' (shown in Exhibit 6.1.8)

This alternative is an option which also allows service integration without the need for a long underground loop into an east-west direction across DND airport property. To achieve this, the Sheppard/Allen Station site must be located approximately 0.5 km south of the intersection permitting a curve to the east, north of the station.

The northerly extension of the present Spadina line would again commence at the northeast corner of Wilson Yard and continue up to the east-west runway in open-cut following a similar alignment to that of Alternative 'A-2'.

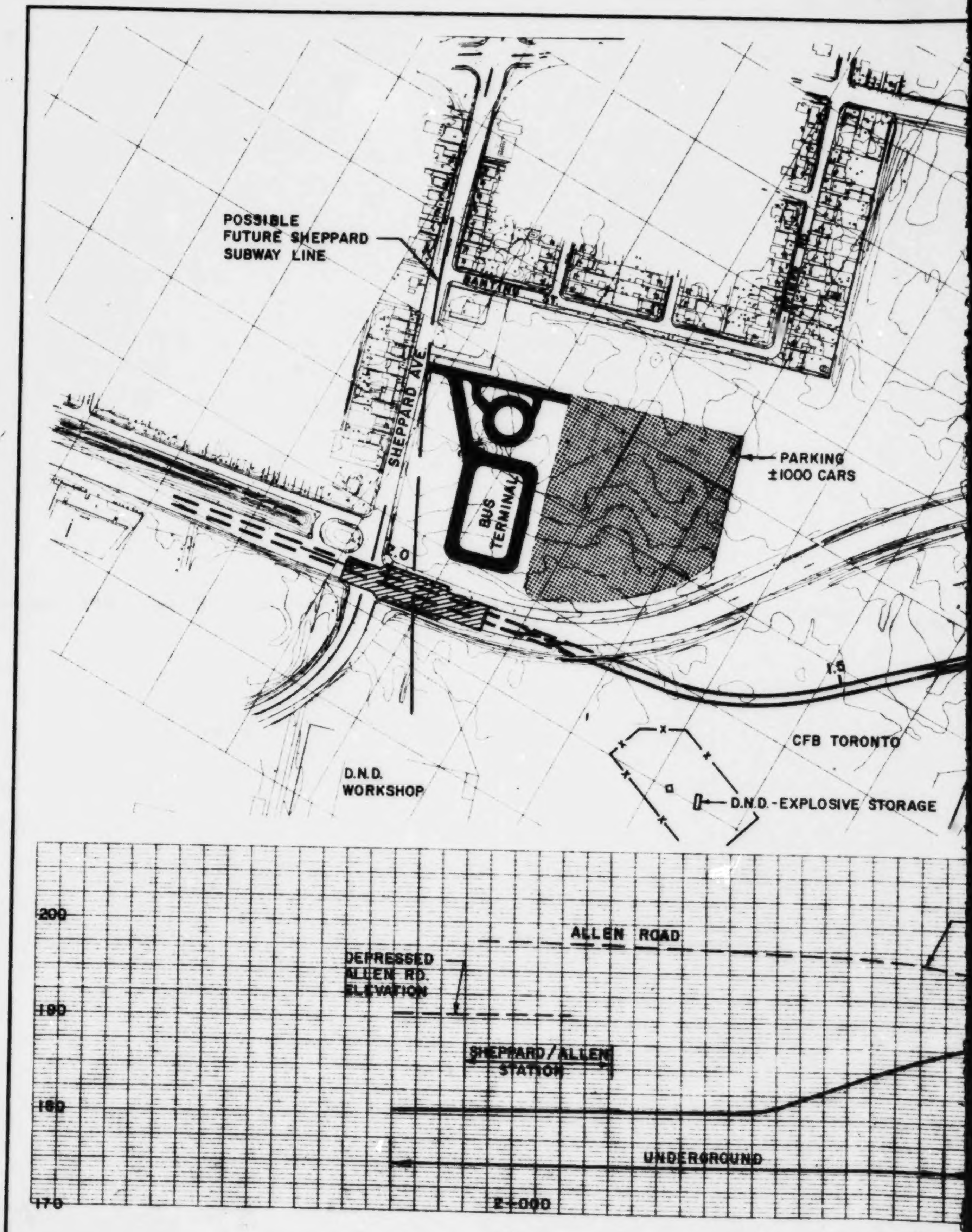
At the south edge of the runway zone, the tracks would enter an underground section constructed by the cut-and-cover method. This section would pass under the runway and continue north passing under Allen Road to reach the Metro-owned land on the east side of the road allowance.

The Sheppard/Allen Station would be positioned with the southern third of the platform length within the Allen Road crossing. This is the most northerly location which leaves enough distance to accommodate a curve to the east onto a feasible alignment for a possible Sheppard Line. From this location, it is also possible to extend the Spadina line either directly north into the strip of public land between Allen Road and Dufferin Street, or to the northwest by curving westward into the Sheppard Avenue road allowance. While this curvature to the north-west is feasible using track design standards above minimum, the 260 metre curve to the east represents a compromise to minimum curve radius of 300 metres.

Terminal facilities for this alternative would be generally north of the underground station complex, to improve accessibility from the Sheppard Avenue/Allen Road intersection. The station configuration employs the "parallel" station concept since both, the Spadina line platforms, and those of a possible Sheppard line, would be in a north-south direction one above the other. Once again the phasing of construction is complex since provision must be made in the first phase for the ultimate overlapping of the two lines on either side of the station.

Characteristics of Alignment B-2

Overall Length (including 200 metre tail track north of Sheppard/Allen station)	:	1890	metres
Length on surface	:	900	metres
Length in open-cut	:	300	metres
Length underground	:	690	metres
Min. radius of curvature	:	two 300 metre curves	
Max. grade required (and length of max. grade)	:	1.6 % over 170 metres	
Length of existing track incorporated into alignment	:	650	metres
Distance the alignment extends north of centre-line	:	alignment terminates south of Sheppard Avenue	
Type of Station (as described in Section 6.2)	:	Parallel station with all facilities in South-east quadrant	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SHEPPARD AVE.
BUS TERMINAL
PARKING ±1000 CARS
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D.N.D. WORKSHOP
D.N.D. - EXPLOSIVE STORAGE
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190
180
170
ALLEN ROAD
DEPRESSED ALLEN RD. ELEVATION
SHEPPARD / ALLEN STATION
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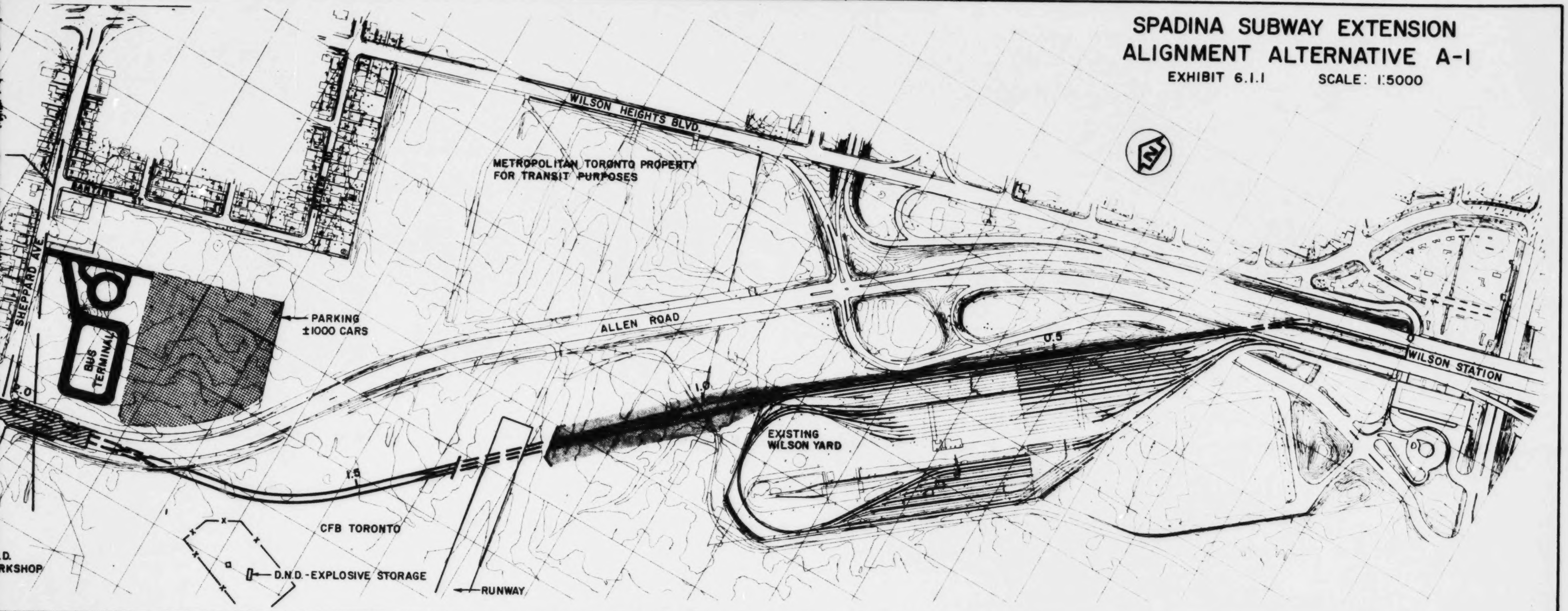
2+000

SPADINA SUBWAY EXTENSION
ALIGNMENT ALTERNATIVE A-1

EXHIBIT 6.1.1 SCALE: 1:5000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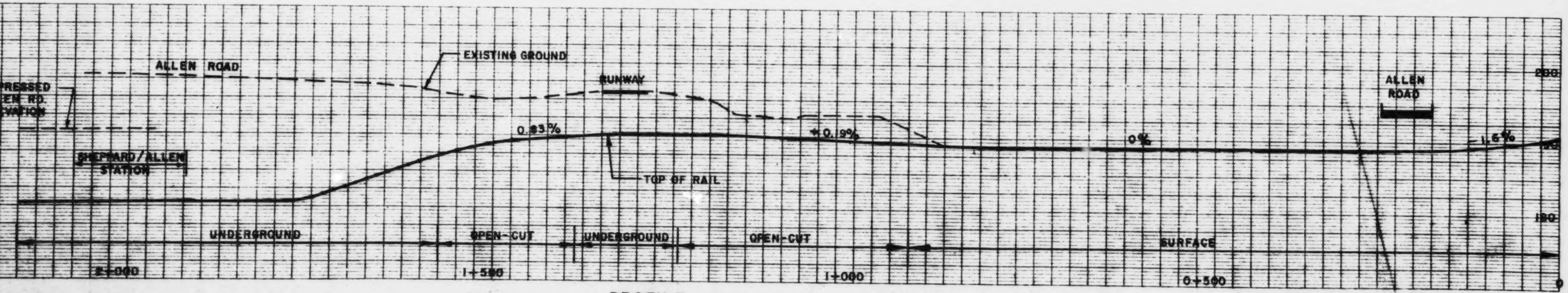
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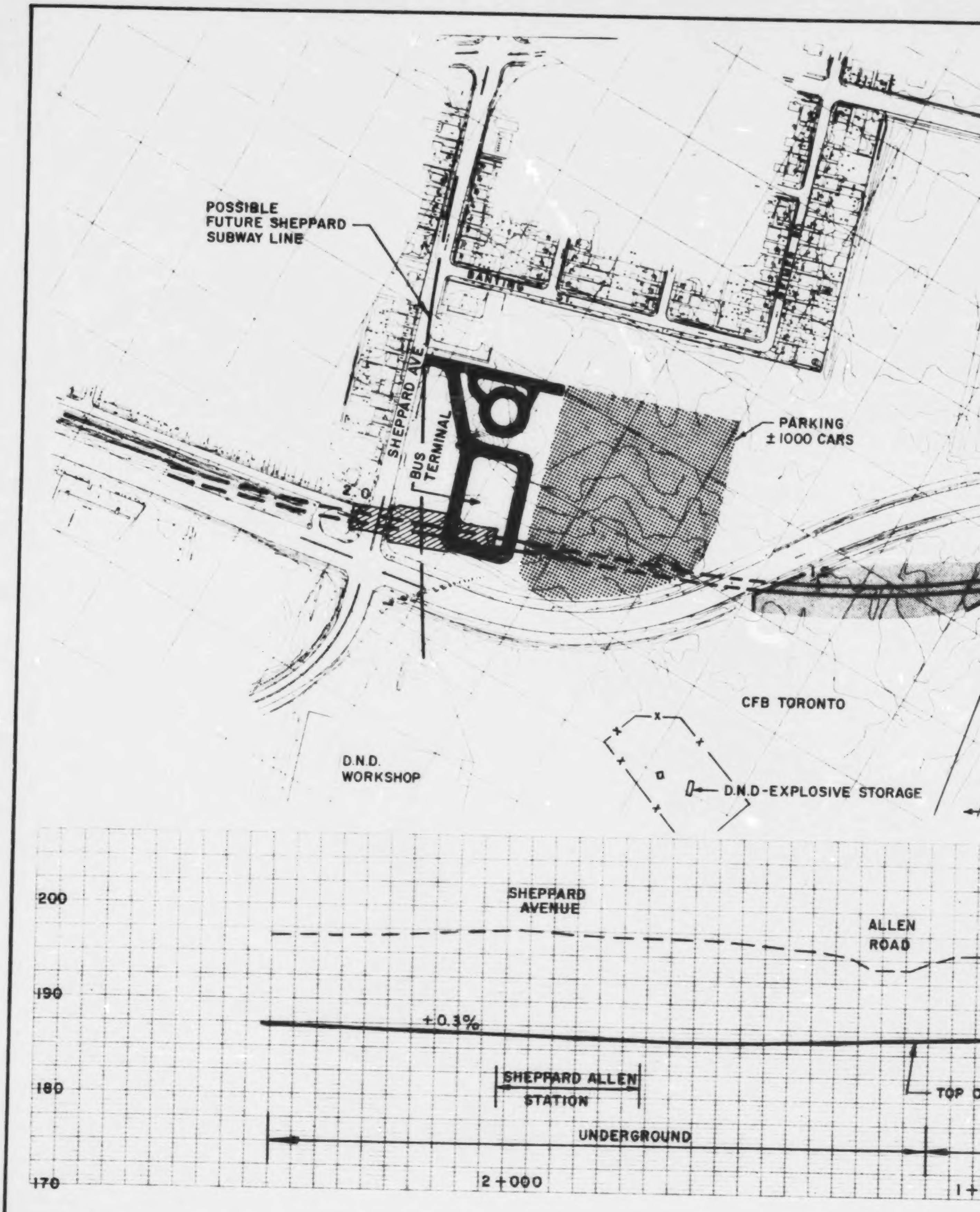
PROFILE

SCALE: HOR. 1:5000, VERT. 1:500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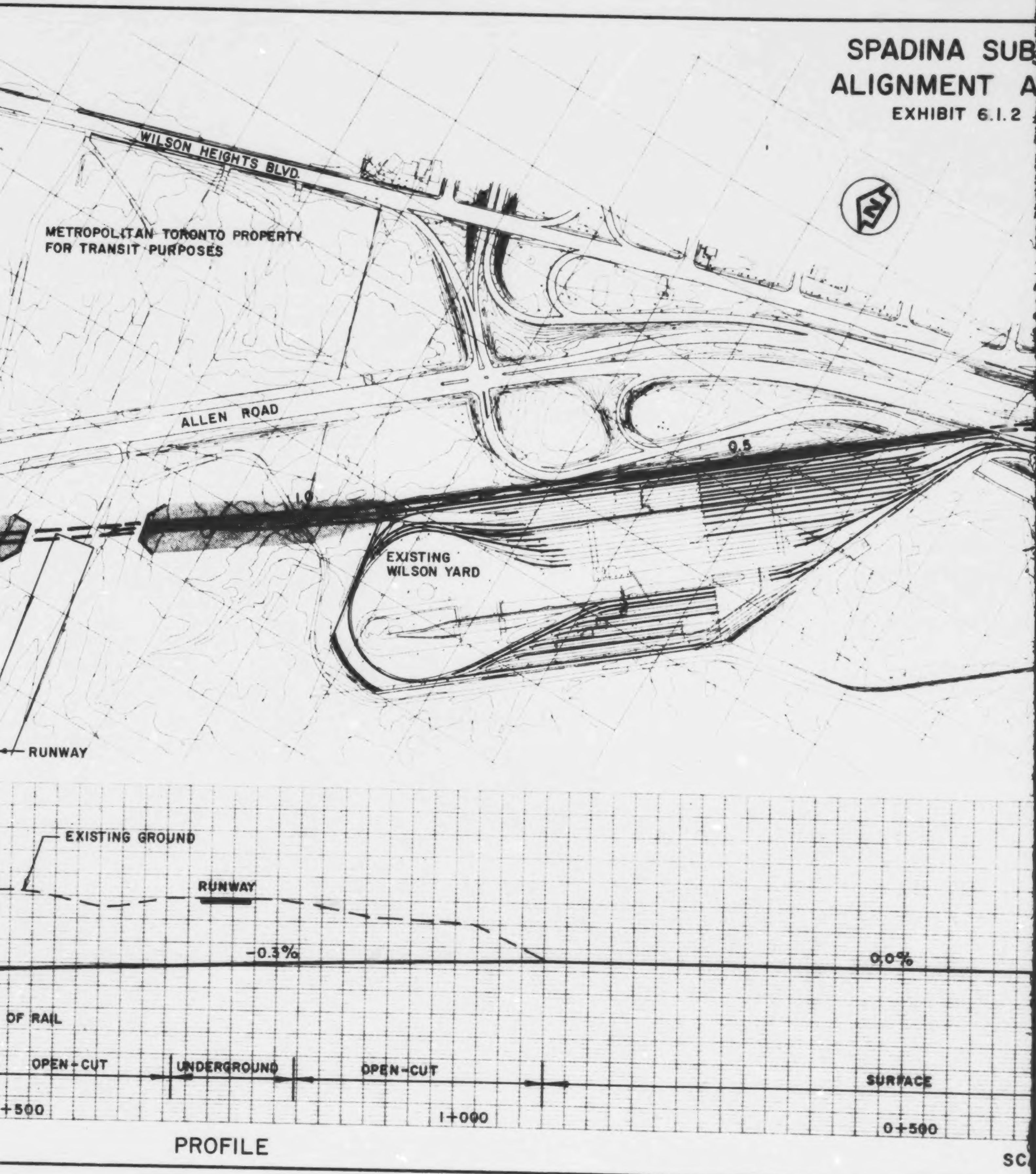
SPADINA SUB
ALIGNMENT A
EXHIBIT 6.1.2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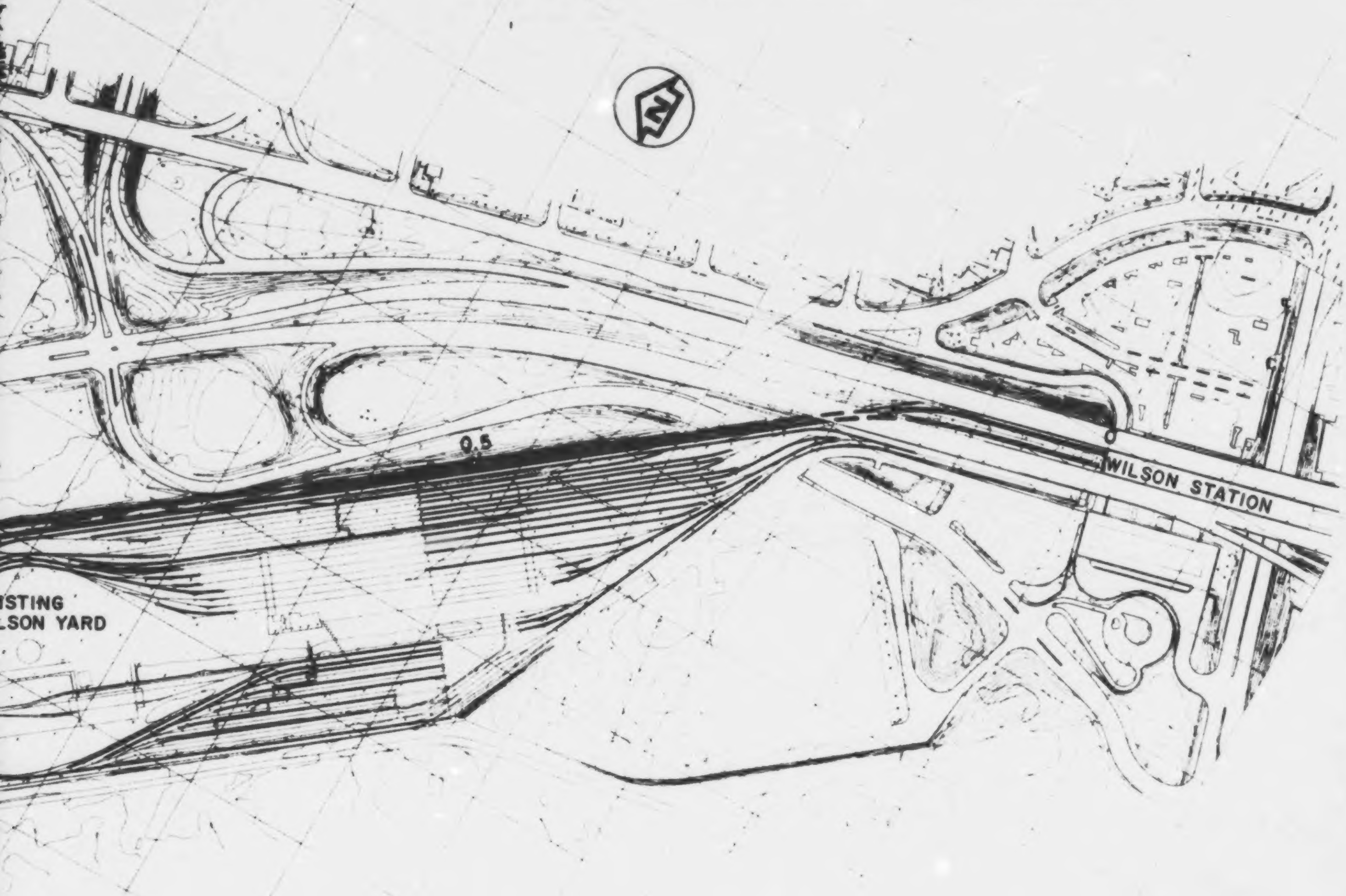
SPADINA SUBWAY EXTENSION
ALIGNMENT ALTERNATIVE A-2

EXHIBIT 6.1.2 SCALE: 1:5000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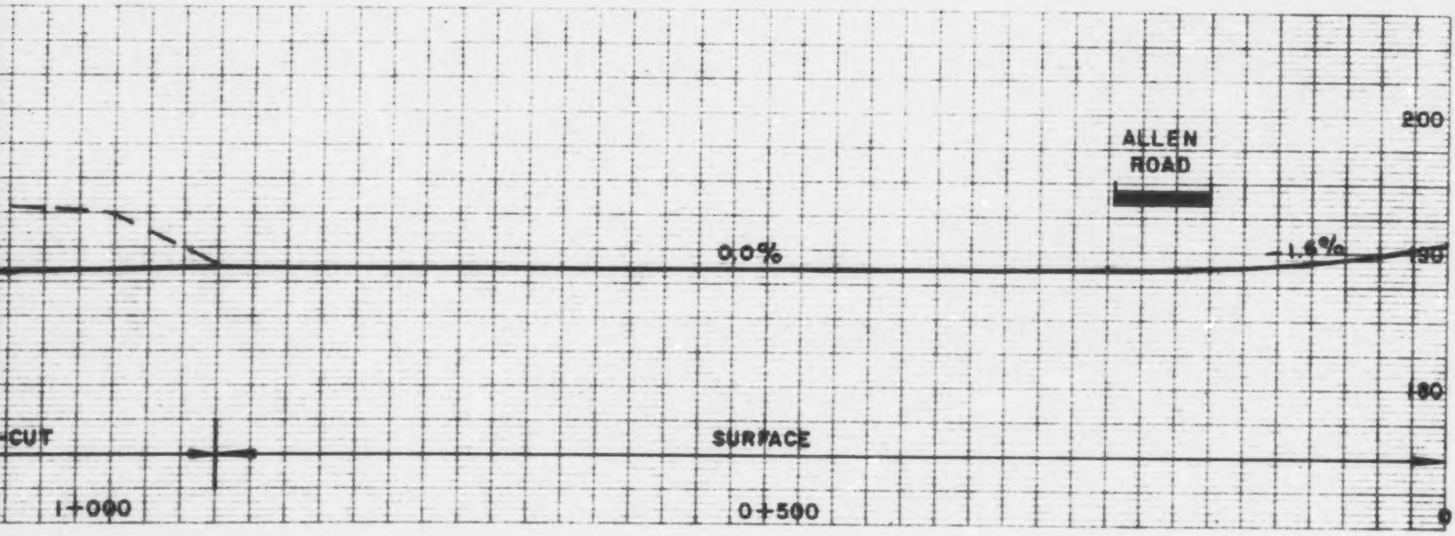
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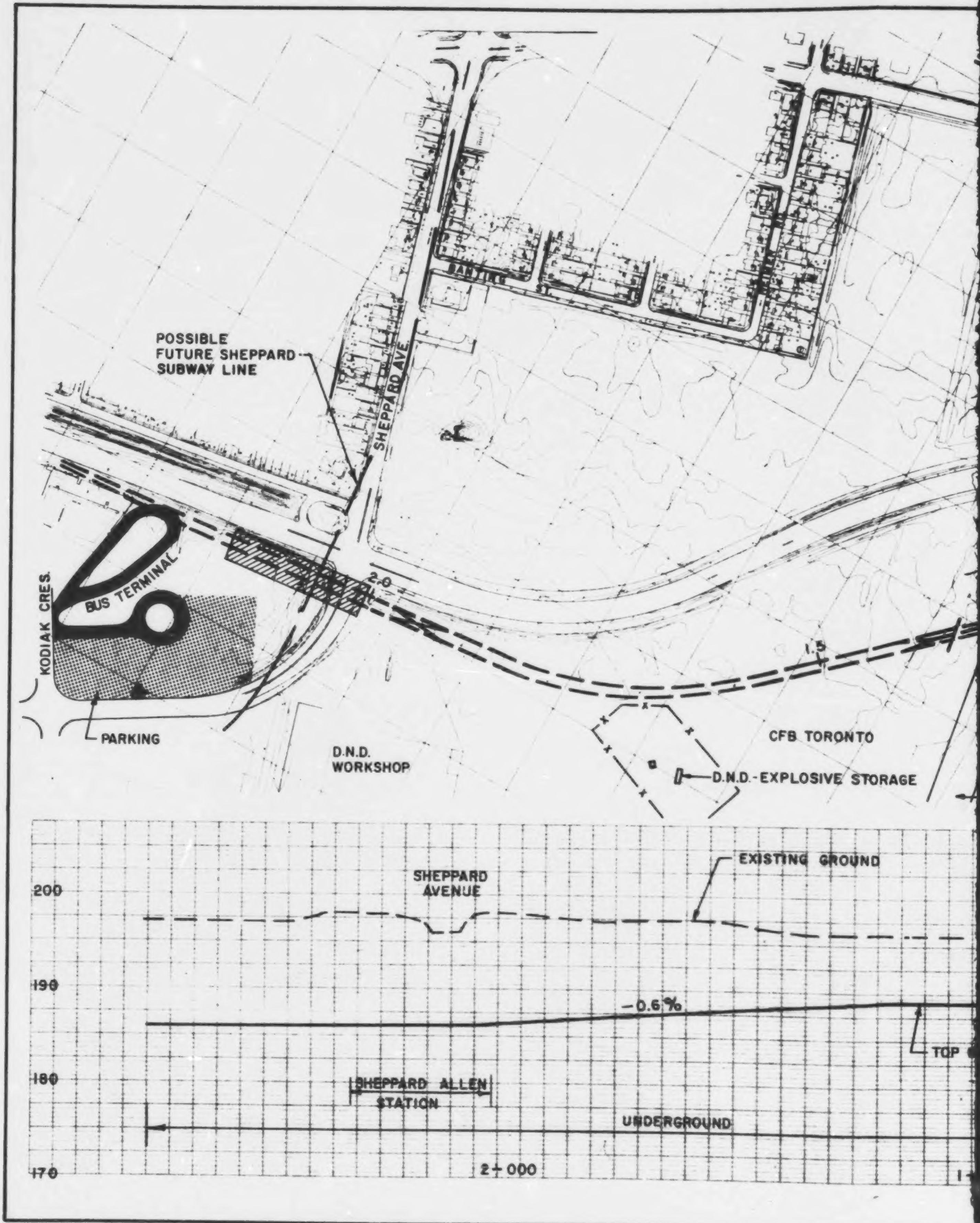
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EXISTING GROUND
-0.6%
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SHEPPARD ALLEN STATION
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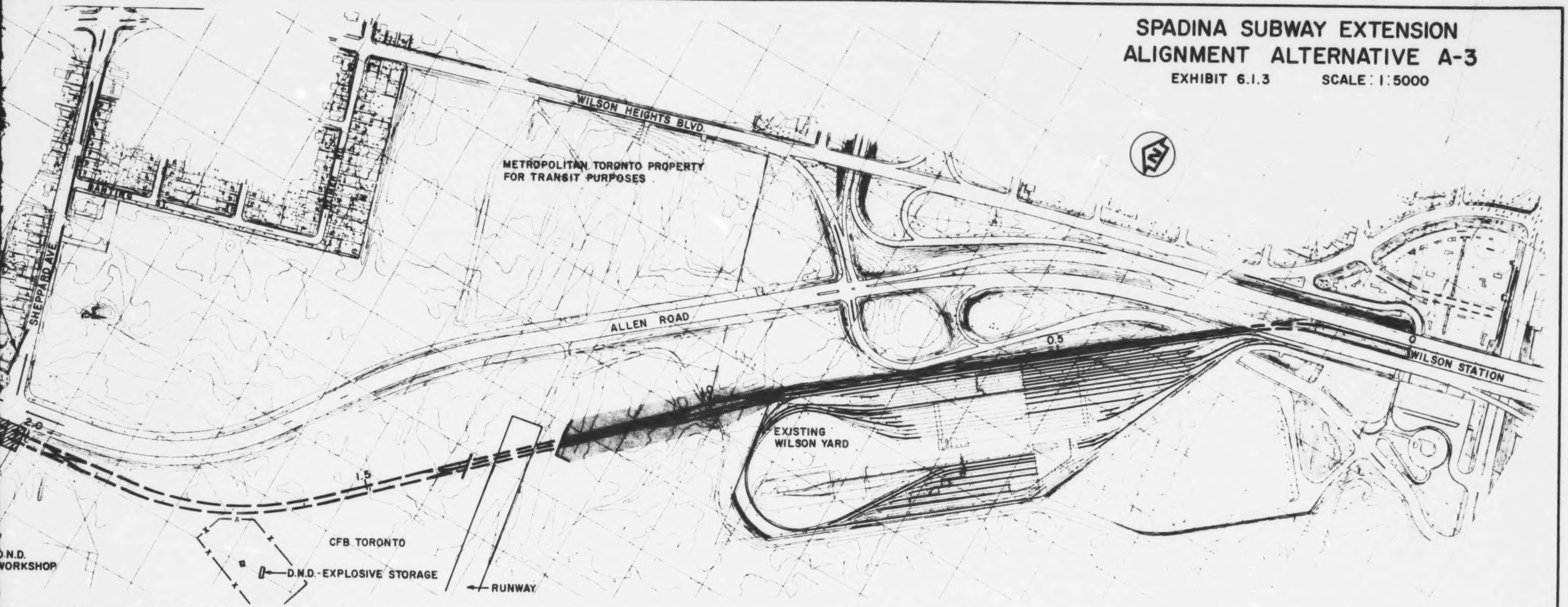
SPADINA SUBWAY EXTENSION
ALIGNMENT ALTERNATIVE A-3

EXHIBIT 6.1.3 SCALE: 1:5000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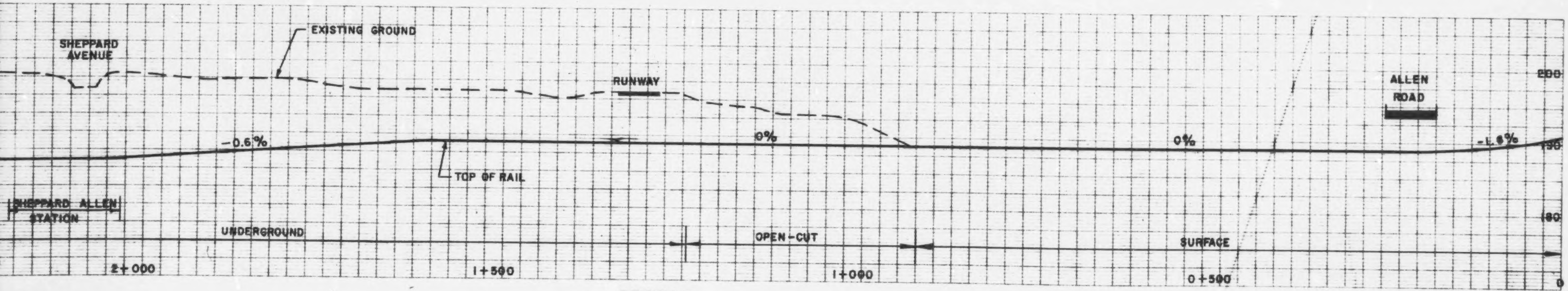
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SHEPPARD ALLEN STATION
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UNDERGROUND
OPEN-CUT
SURFACE
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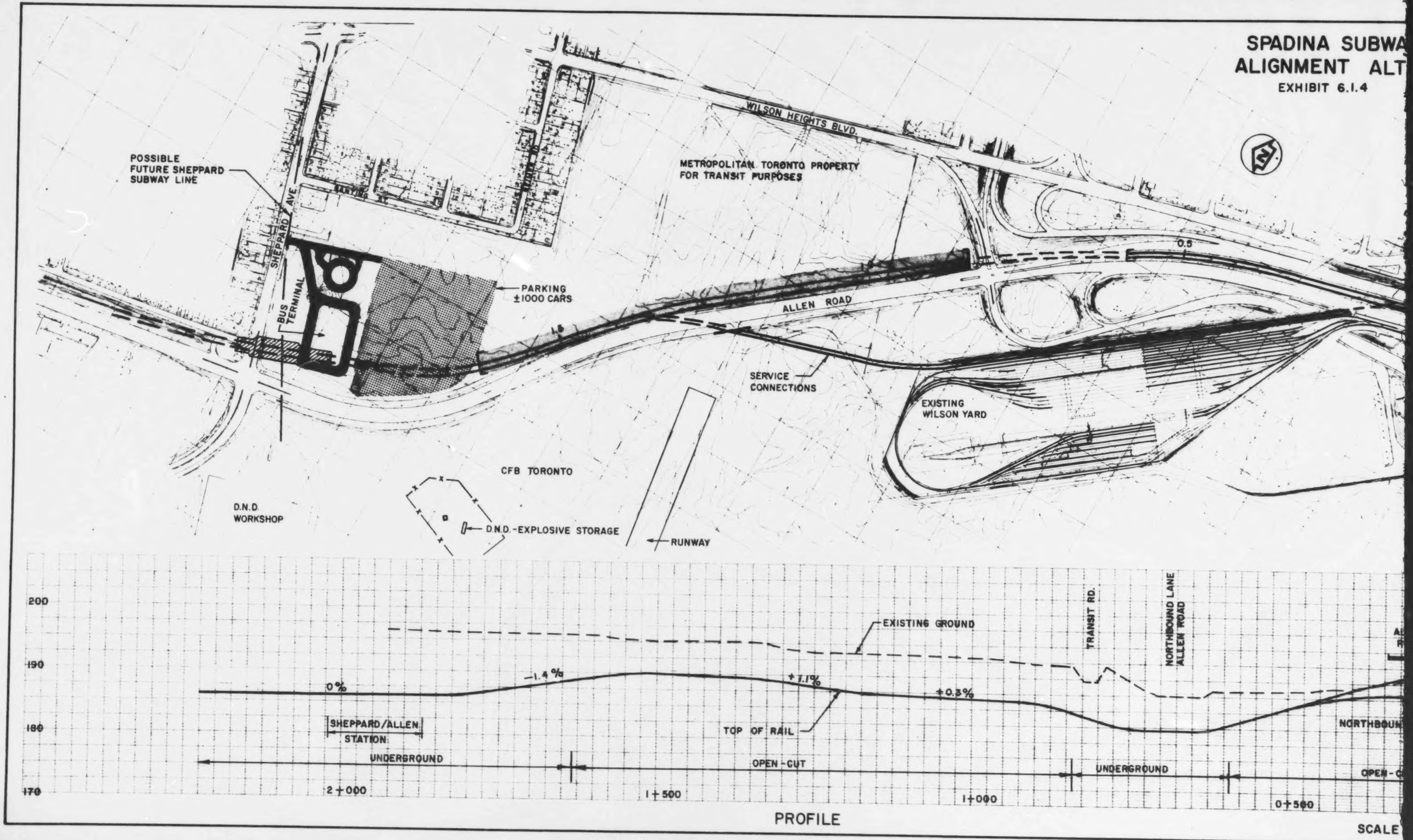
PROFILE

SCALE: HOR. 1:5000, VERT. 1:500

SPADINA SUBWA
ALIGNMENT ALT
EXHIBIT 6.1.4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CFB TORONTO
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PROFILE
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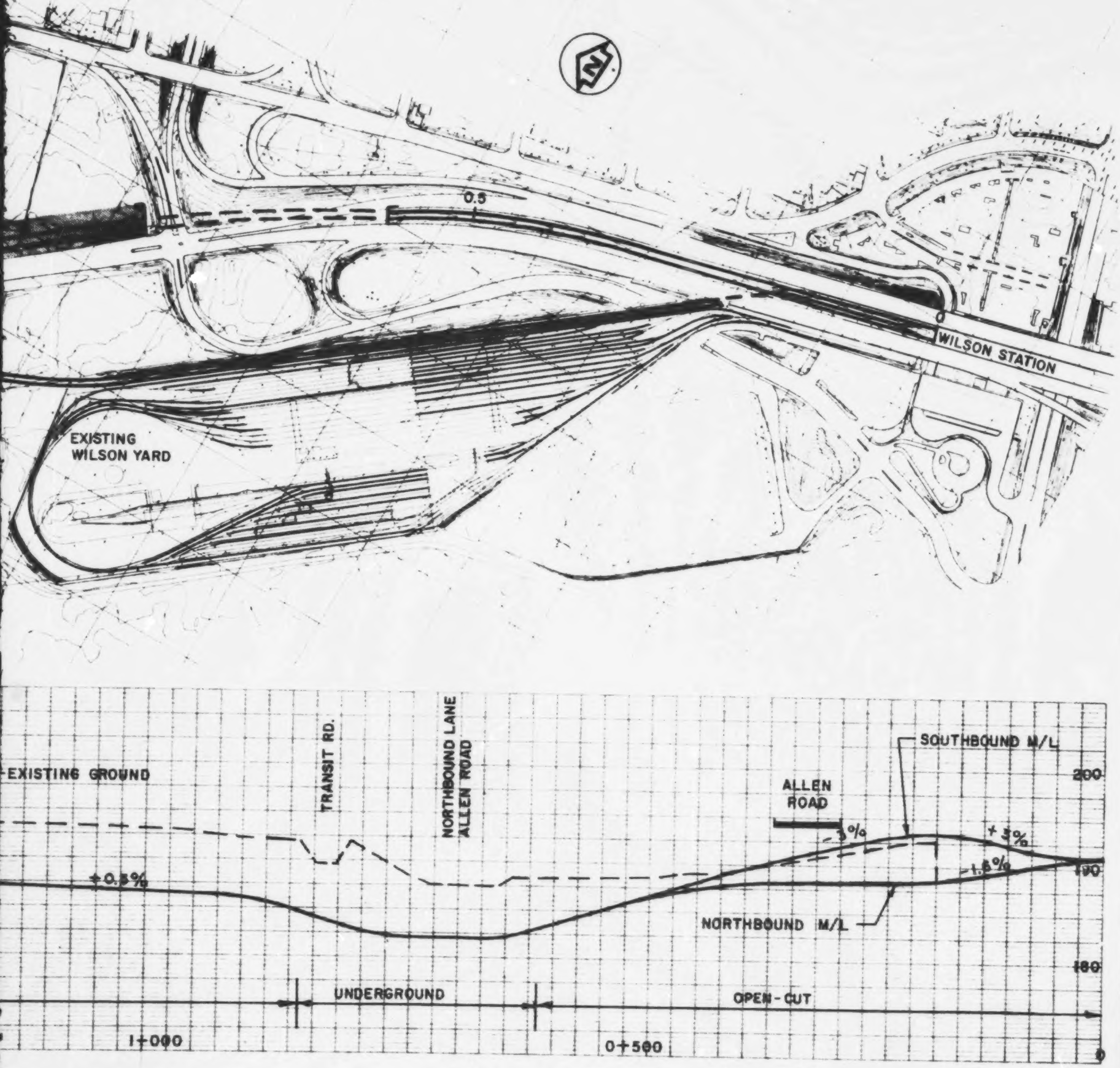
SPADINA SUBWAY EXTENSION
ALIGNMENT ALTERNATIVE A-4

EXHIBIT 6.1.4 SCALE: 1:5000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EXISTING WILSON YARD
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TRANSIT RD.
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UNDERGROUND
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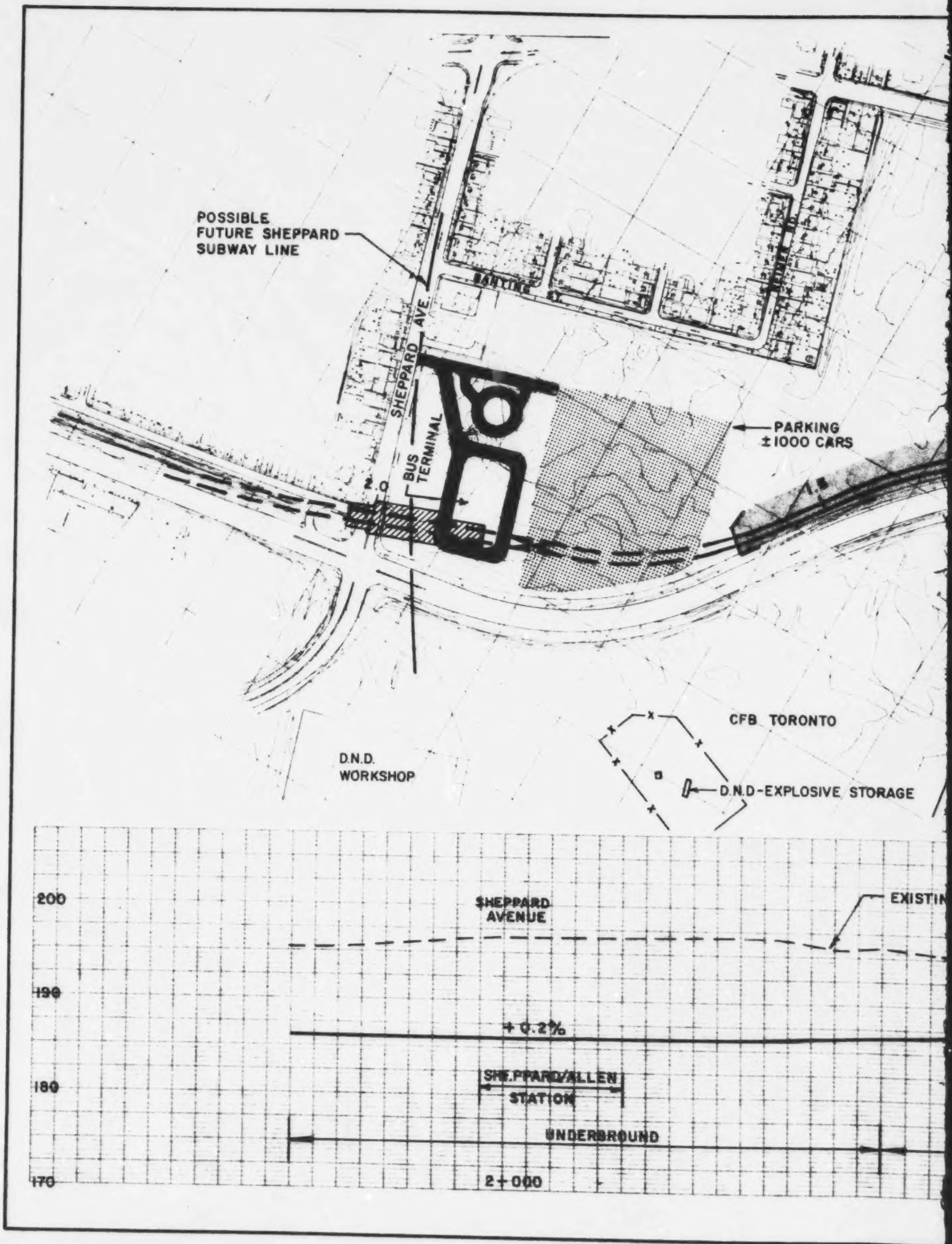
SCALE: HOR. 1:5000, VERT. 1:500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SHEPPARD AVE.
BANTING ST.
BUS TERMINAL
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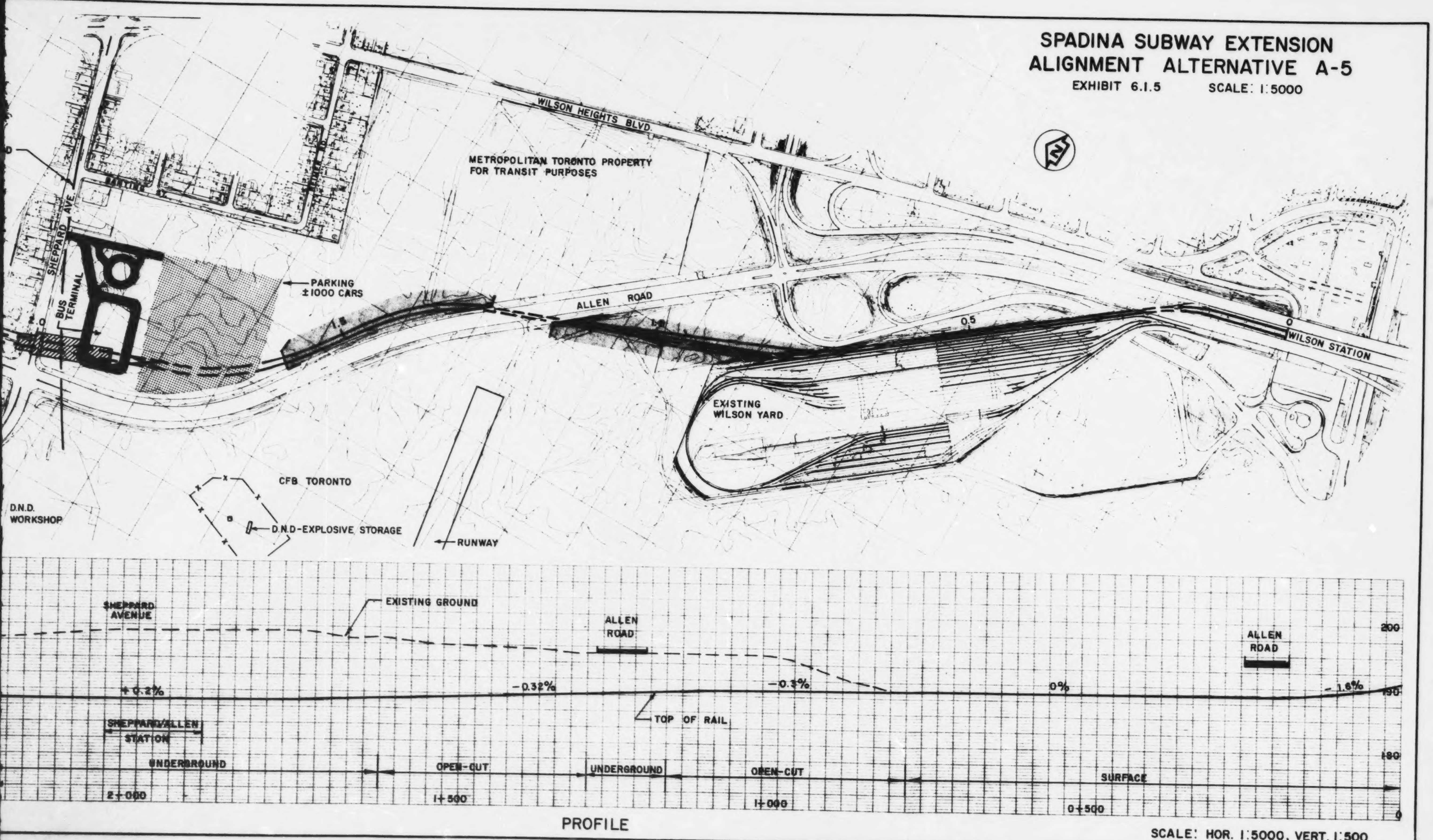
PARKING ±1000 CARS
1.5
CFB TORONTO
D.N.D. WORKSHOP
D.N.D-EXPLOSIVE STORAGE
200
SHEPPARD AVENUE
EXISTIN
190
+0.2%
180
SHEPPARD/ALLEN STATION
UNDERGROUND
170
2+000

SPADINA SUBWAY EXTENSION ALIGNMENT ALTERNATIVE A-5

EXHIBIT 6.1.5 SCALE: 1:5000

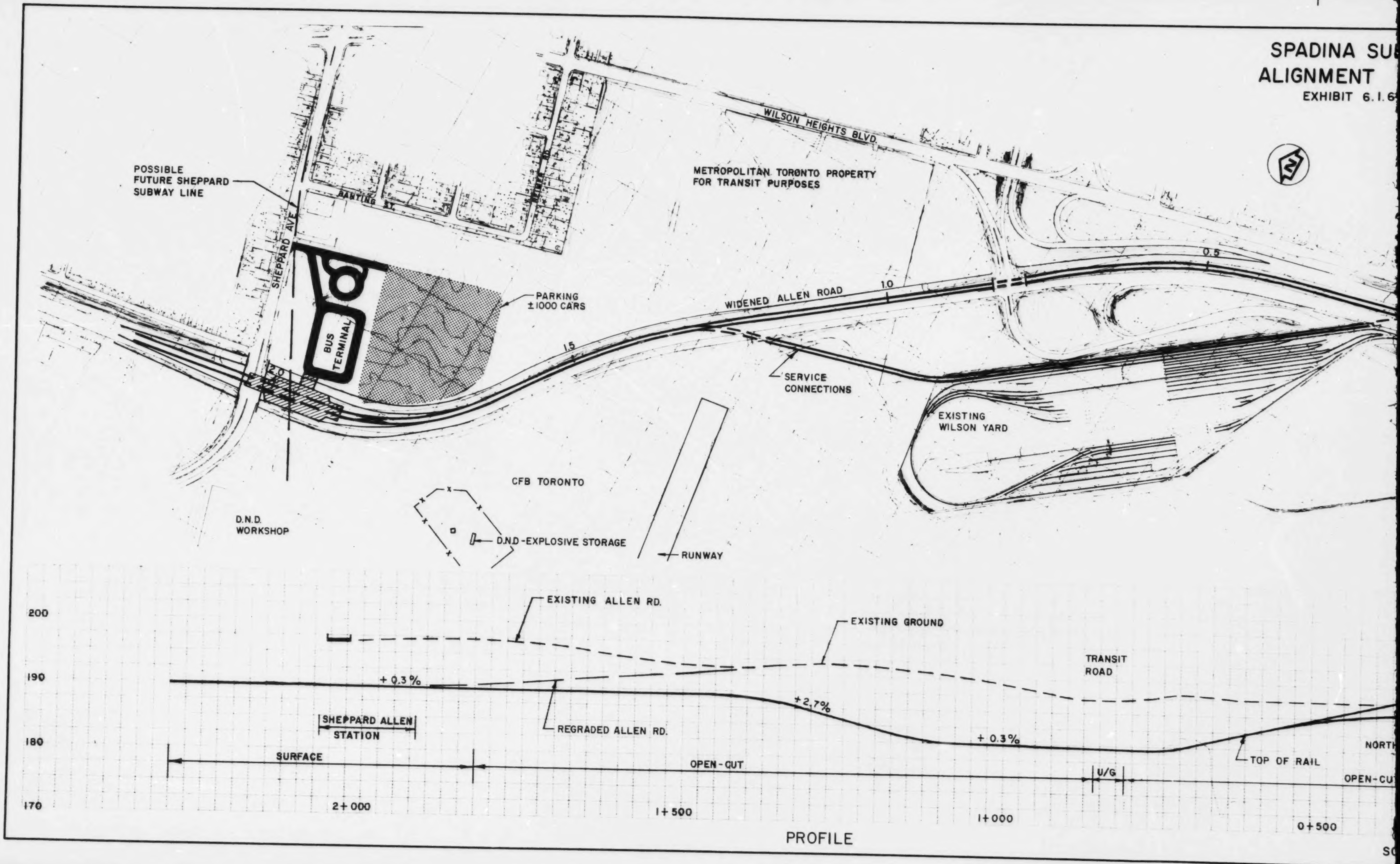

WILSON HEIGHTS BLVD.
METROPOLITAN TORONTO PROPERTY FOR TRANSIT PURPOSES
SHEPPARD AVE.
BUS TERMINAL
PARKING ±1000 CARS
ALLEN ROAD
2.0
1.5
1.0
0.5
0
WILSON STATION
EXISTING WILSON YARD
CFB TORONTO
D.N.D. WORKSHOP
D.N.D-EXPLOSIVE STORAGE
RUNWAY
SHEPPARD AVENUE
EXISTING GROUND
ALLEN ROAD
ALLEN ROAD
200
+0.2%
-0.32%
-0.3%
0%
-1.6%
190
TOP OF RAIL
SHEPPARD/ALLEN STATION
180
UNDERGROUND
OPEN-CUT
UNDERGROUND
OPEN-CUT
SURFACE
2+000
1+500
1+000
0+500
0

PROFILE

SCALE: HOR. 1:5000, VERT. 1:500

SPADINA SU
ALIGNMENT

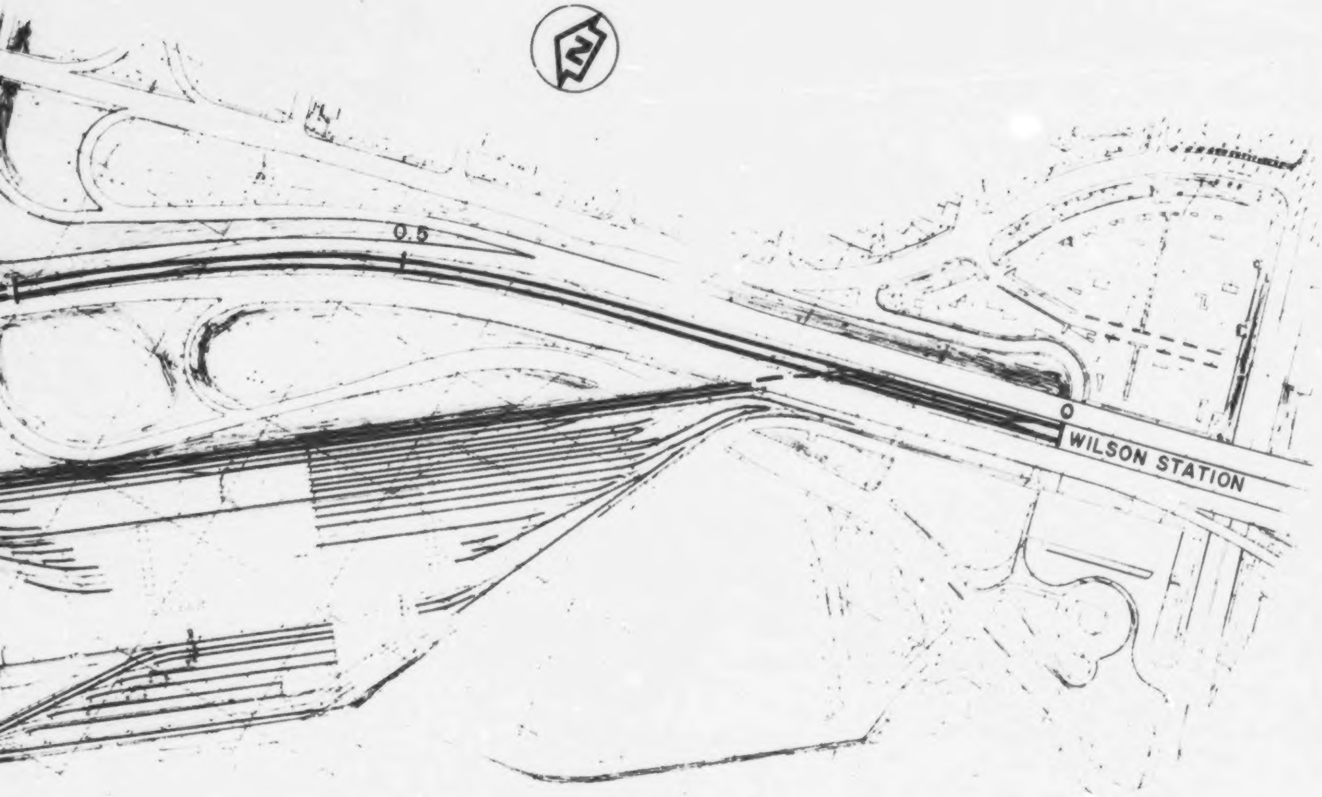
EXHIBIT 6.1.6

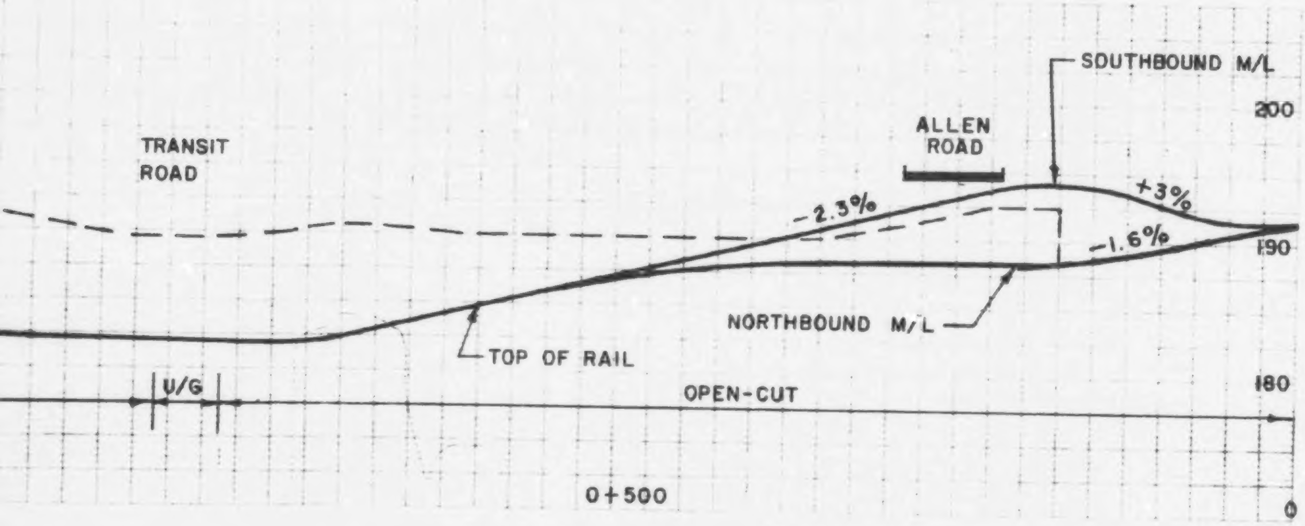


POSSIBLE FUTURE SHEPPARD SUBWAY LINE
SHEPPARD AVE
BANTING ST.
WILSON HEIGHTS BLVD.
METROPOLITAN TORONTO PROPERTY FOR TRANSIT PURPOSES
PARKING ±1000 CARS
BUS TERMINAL
WIDENED ALLEN ROAD
0.5
1.0
1.5
2.0
SERVICE CONNECTIONS
EXISTING WILSON YARD
CFB TORONTO
D.N.D. WORKSHOP
D.N.D.-EXPLOSIVE STORAGE
RUNWAY
200
190
180
170
EXISTING ALLEN RD.
EXISTING GROUND
TRANSIT ROAD
+0.3%
+2.7%
+0.3%
SHEPPARD ALLEN STATION
REGRADED ALLEN RD.
TOP OF RAIL
NORTH
SURFACE
OPEN-CUT
U/G
OPEN-CU
2+000
1+500
1+000
0+500
PROFILE
SC

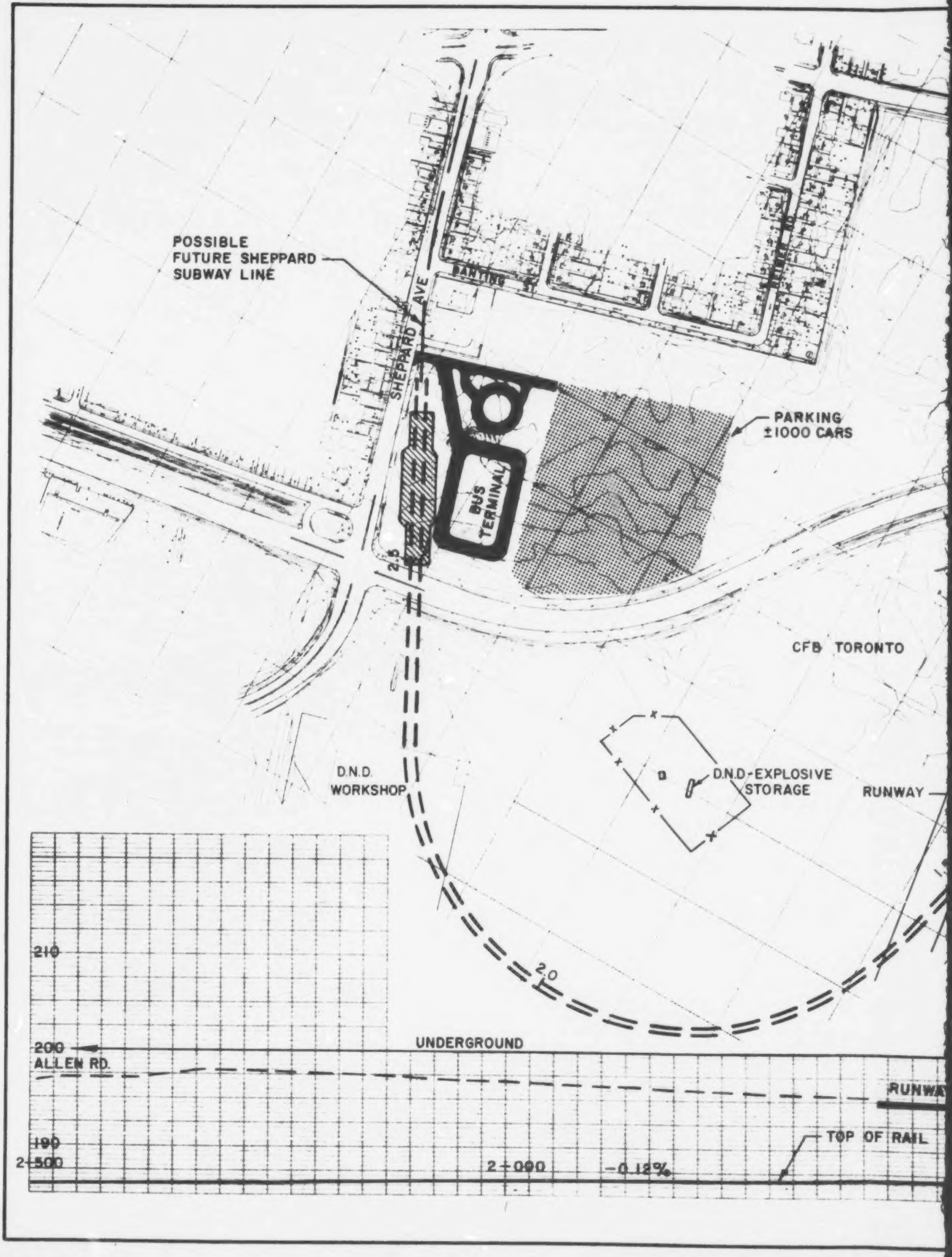
SPADINA SUBWAY EXTENSION
ALIGNMENT ALTERNATIVE A-6

EXHIBIT 6.1.6 SCALE: 1:5000

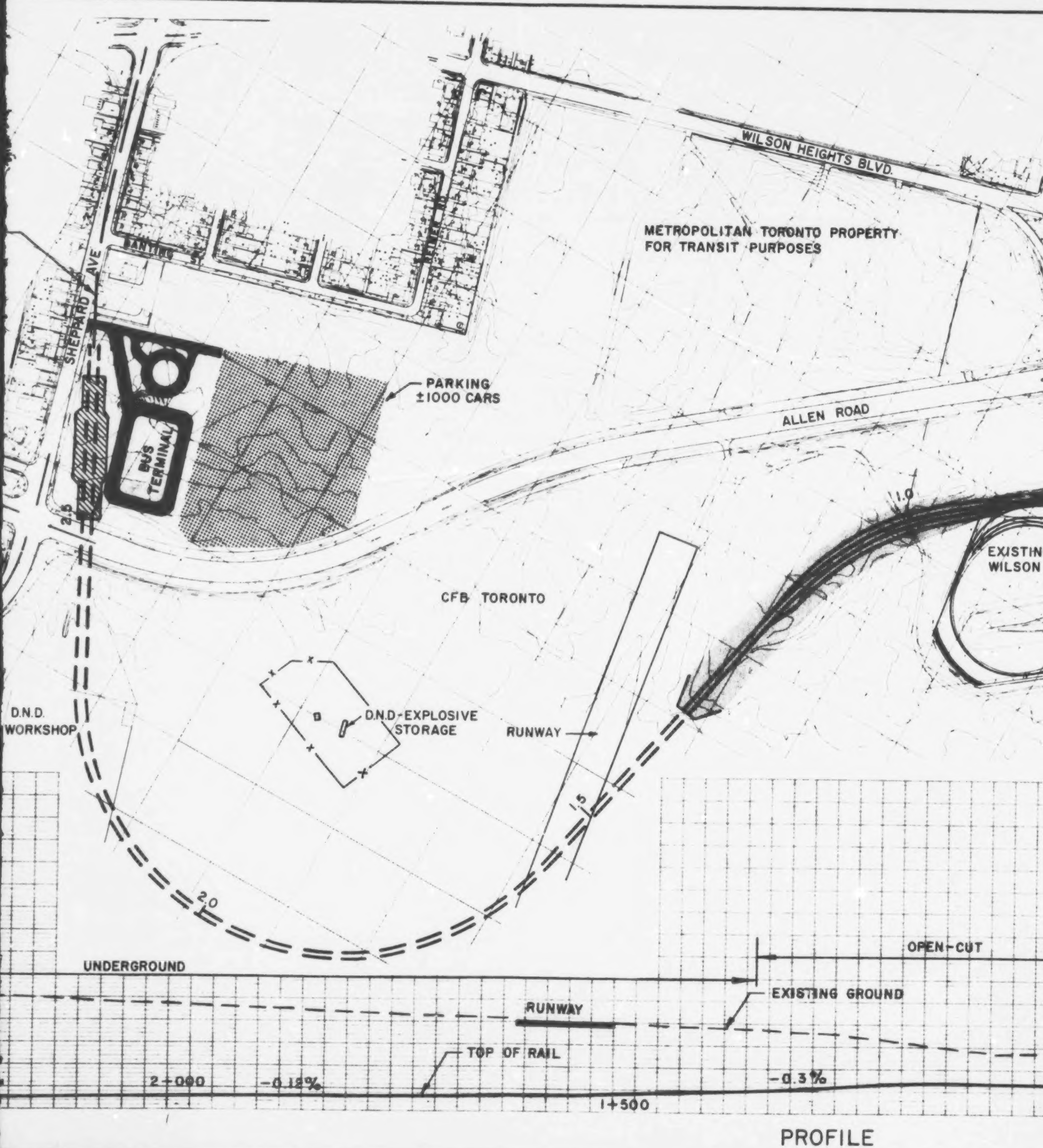

N
0.5
0
WILSON STATION


SOUTHBOUND M/L
200
ALLEN ROAD
TRANSIT ROAD
-2.3%
+3%
-1.6%
190
NORTHBOUND M/L
TOP OF RAIL
U/G
OPEN-CUT
180
0+500
0

SCALE: HOR. 1:5000, VERT. 1:500


POSSIBLE
FUTURE SHEPPARD
SUBWAY LINE
SHEPPARD AVE
BANTING
PARKING
±1000 CARS
BUS
TERMINAL
2.5
CFB TORONTO
D.N.D.
WORKSHOP
D.N.D.-EXPLOSIVE
STORAGE
RUNWAY
2.0
210
200
ALLEN RD.
UNDERGROUND
RUNWA
190
2+500
2+000
-0.12%
TOP OF RAIL

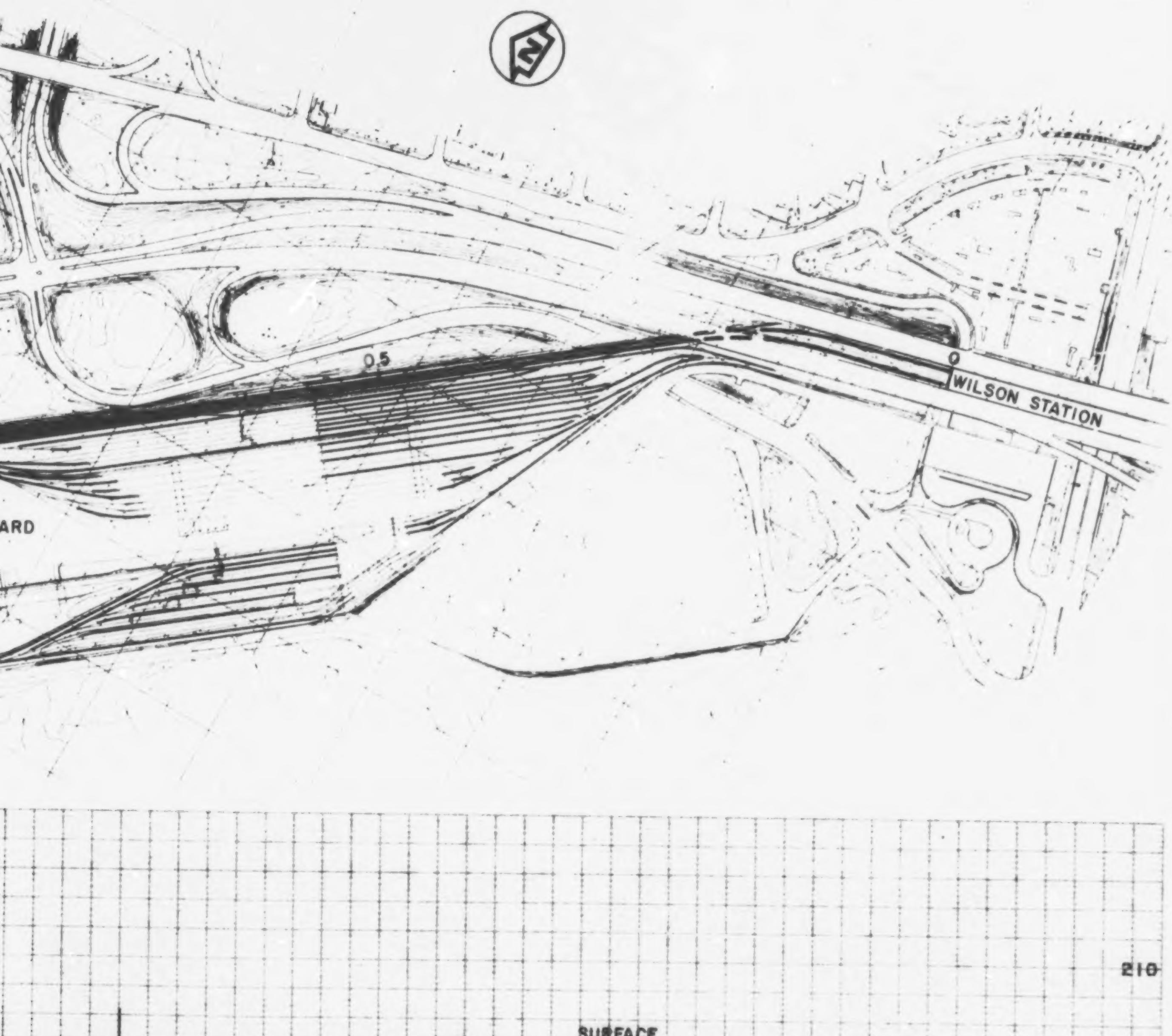
I



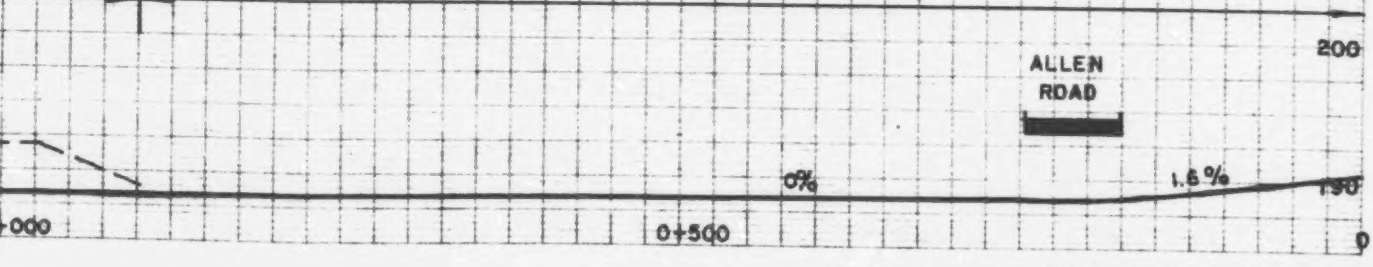
WILSON HEIGHTS BLVD.
BANTING ST
SHEPPARD AVE
METROPOLITAN TORONTO PROPERTY FOR TRANSIT PURPOSES
PARKING ±1000 CARS
BUS TERMINAL
ALLEN ROAD
2.5
1.0
EXISTIN
WILSON
CFB TORONTO
D.N.D. WORKSHOP
D.N.D. EXPLOSIVE STORAGE
RUNWAY
1.5
2.0
OPEN-CUT
UNDERGROUND
EXISTING GROUND
RUNWAY
TOP OF RAIL
2+000
-0.12%
-0.3%
1+500
PROFILE

SPADINA SUBWAY EXTENSION
ALIGNMENT ALTERNATIVE B-1

EXHIBIT 6.1.7 SCALE: 1:5000

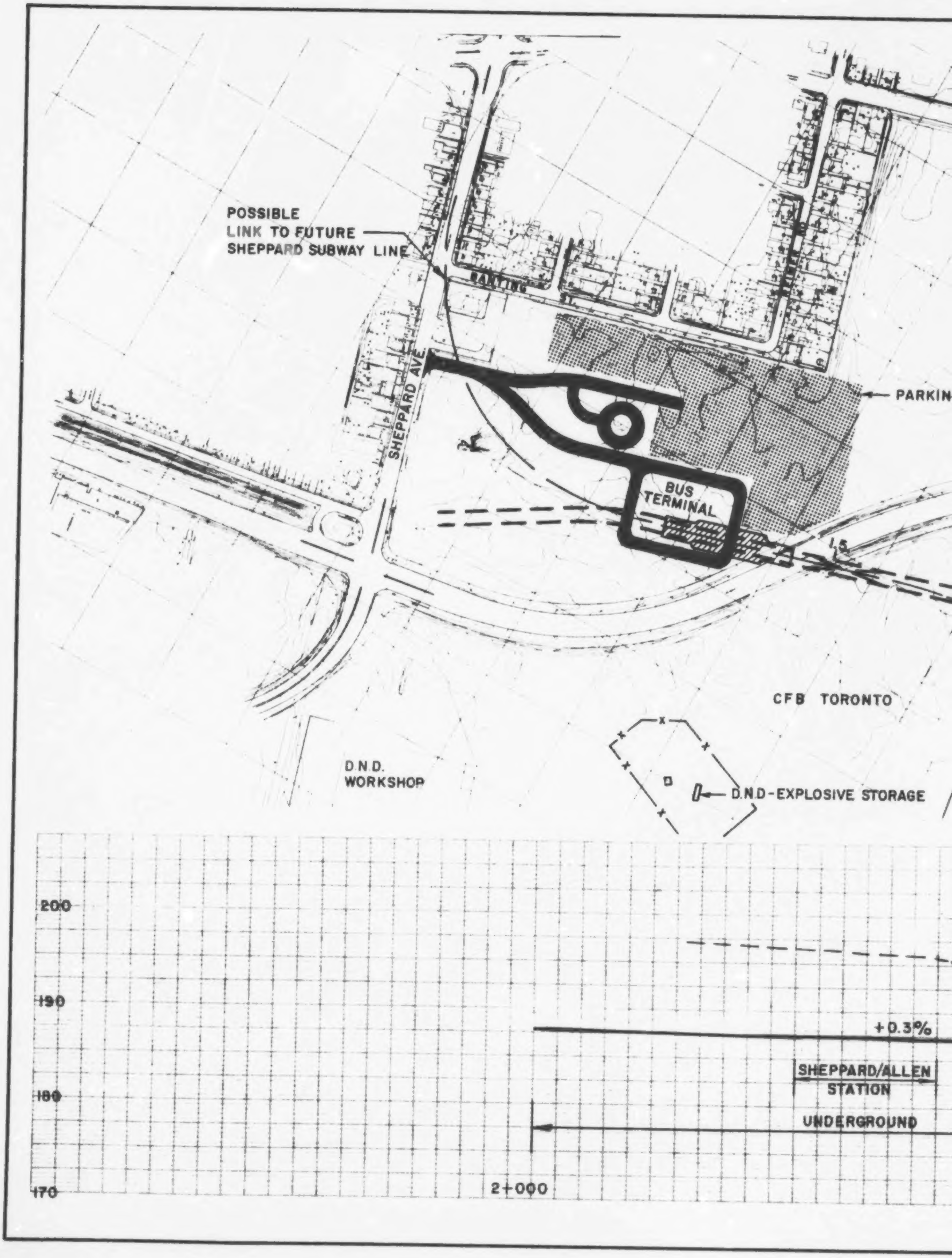


0.5
0
WILSON STATION
ARD



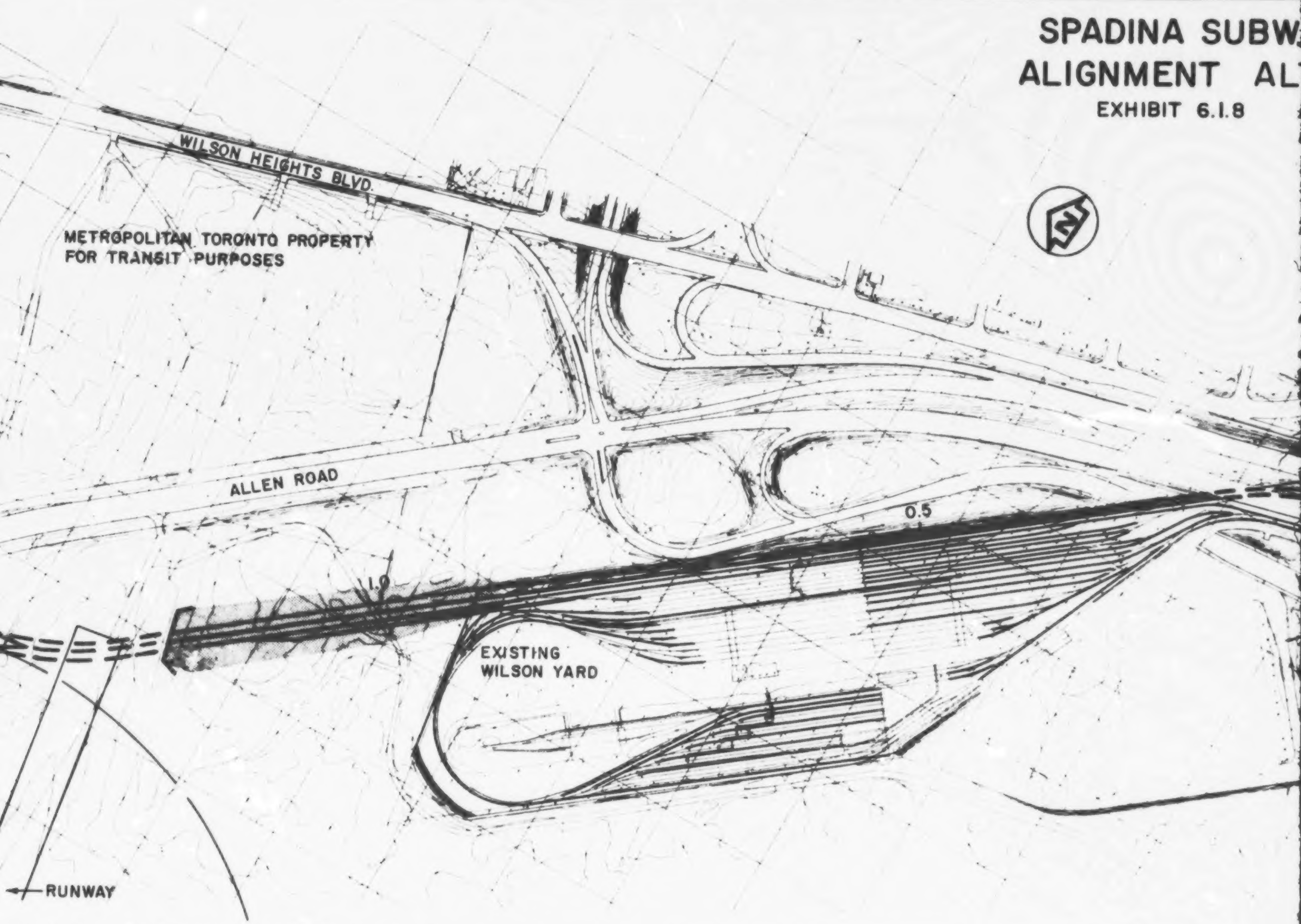
210
SURFACE
200
ALLEN ROAD
0%
1.5%
190
0
-000
0+500

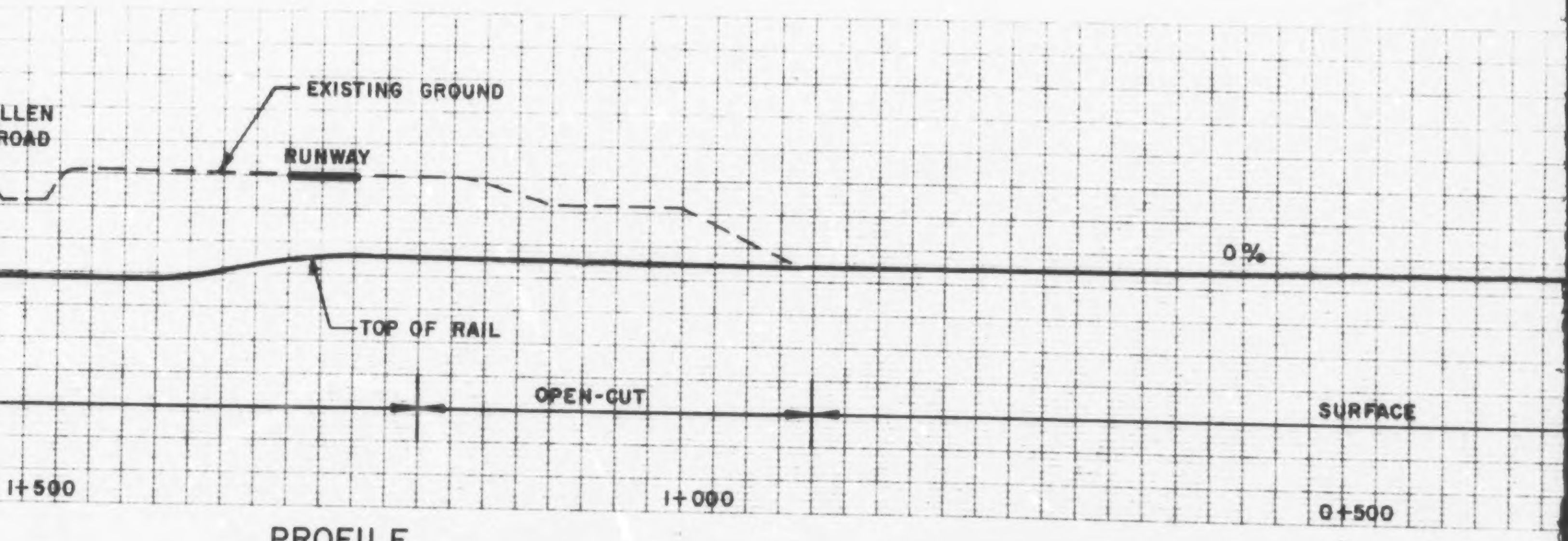
SCALE: HOR. 1:5000, VERT. 1:500


POSSIBLE LINK TO FUTURE SHEPPARD SUBWAY LINE
BANTING
SHEPPARD AVE
PARKIN
BUS TERMINAL
1.5
CFB TORONTO
D.N.D. WORKSHOP
D.N.D-EXPLOSIVE STORAGE
200
190
180
170
2+000
+0.3%
SHEPPARD/ALLEN STATION
UNDERGROUND

SPADINA SUBW
ALIGNMENT AL

EXHIBIT 6.1.8


WILSON HEIGHTS BLVD.
METROPOLITAN TORONTO PROPERTY
FOR TRANSIT PURPOSES
ALLEN ROAD
0.5
1.0
EXISTING
WILSON YARD
RUNWAY

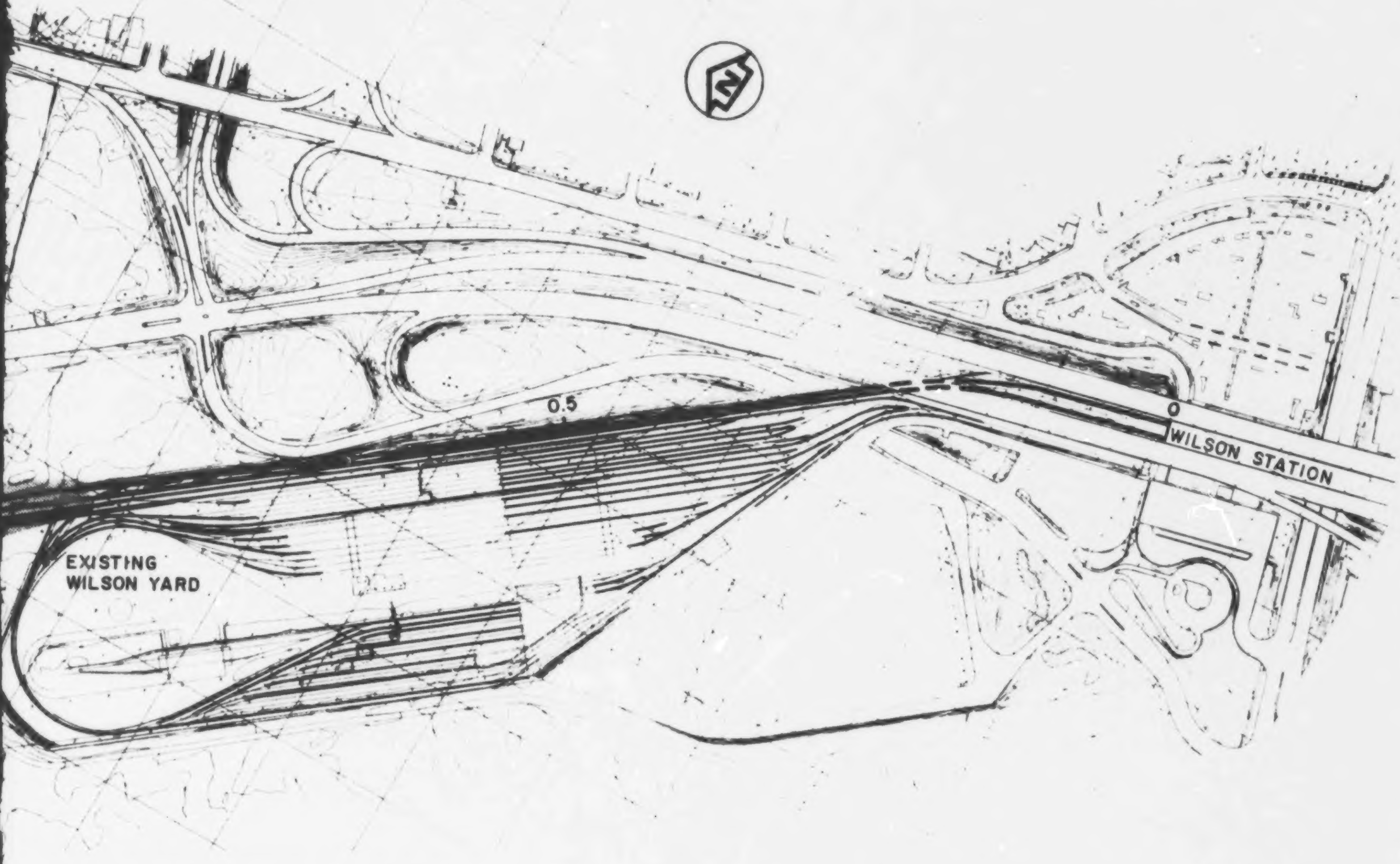

LLEN
ROAD
EXISTING GROUND
RUNWAY
0%
TOP OF RAIL
OPEN-CUT
SURFACE
1+500
1+000
0+500

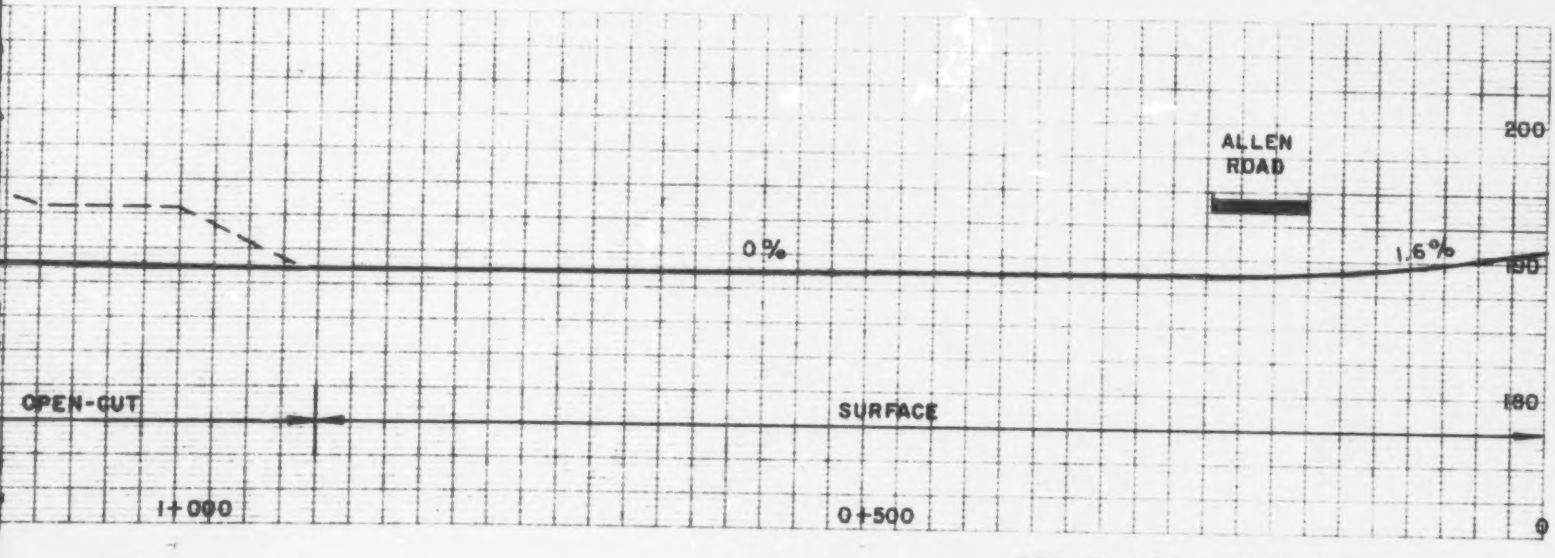
PROFILE

SCAL

SPADINA SUBWAY EXTENSION
ALIGNMENT ALTERNATIVE B-2

EXHIBIT 6.1.8 SCALE: 1:5000


0.5
0
WILSON STATION
EXISTING WILSON YARD


200
ALLEN ROAD
0%
1.6%
190
OPEN-CUT
SURFACE
180
1+000
0+500
0

SCALE: HOR. 1:5000, VERT. 1:500

6.2 Station Configuration Alternatives

In the preceding discussion of alignment alternatives, the various station locations and configuration planned for each alternative were identified. These can be grouped by location as follows:

Stations in Southeast Quadrant of Sheppard Ave./Allen Road Intersection.

- Cross-station located on property owned by Metropolitan Toronto and under Sheppard Avenue Road allowance incorporated in alignment alternatives A-2, A-4 and A-5.

- Cross-station on Metro Toronto property and under Allen Road right-of-way as required for alignment alternative A-1.
- Cross-station on Metro Toronto property and within the median of a widened, divided Allen Road proposed for Alignment alternative A-6.

- Parallel station in north-south direction on Metro Toronto property and under Allen Road right-of-way incorporated in alignment alternative B-2.

- Parallel station in east-west direction on Metro Toronto property required for alignment alternative B-1.

Station in Northwest Quadrant of Sheppard Ave./Allen Road Intersection.

- Cross-station on privately-owned property and under Sheppard Ave. right-of-way as required in alignment alternative A-3.

Schematic diagrams of the four layouts with significant differences are shown in Exhibits 6.2.1. to 6.2.4. and a general description of each alternative follows:

6.2.1 Description of Alternatives in Southeast Quadrant

Cross-station for Alignments A-2, A-4, and A-5:

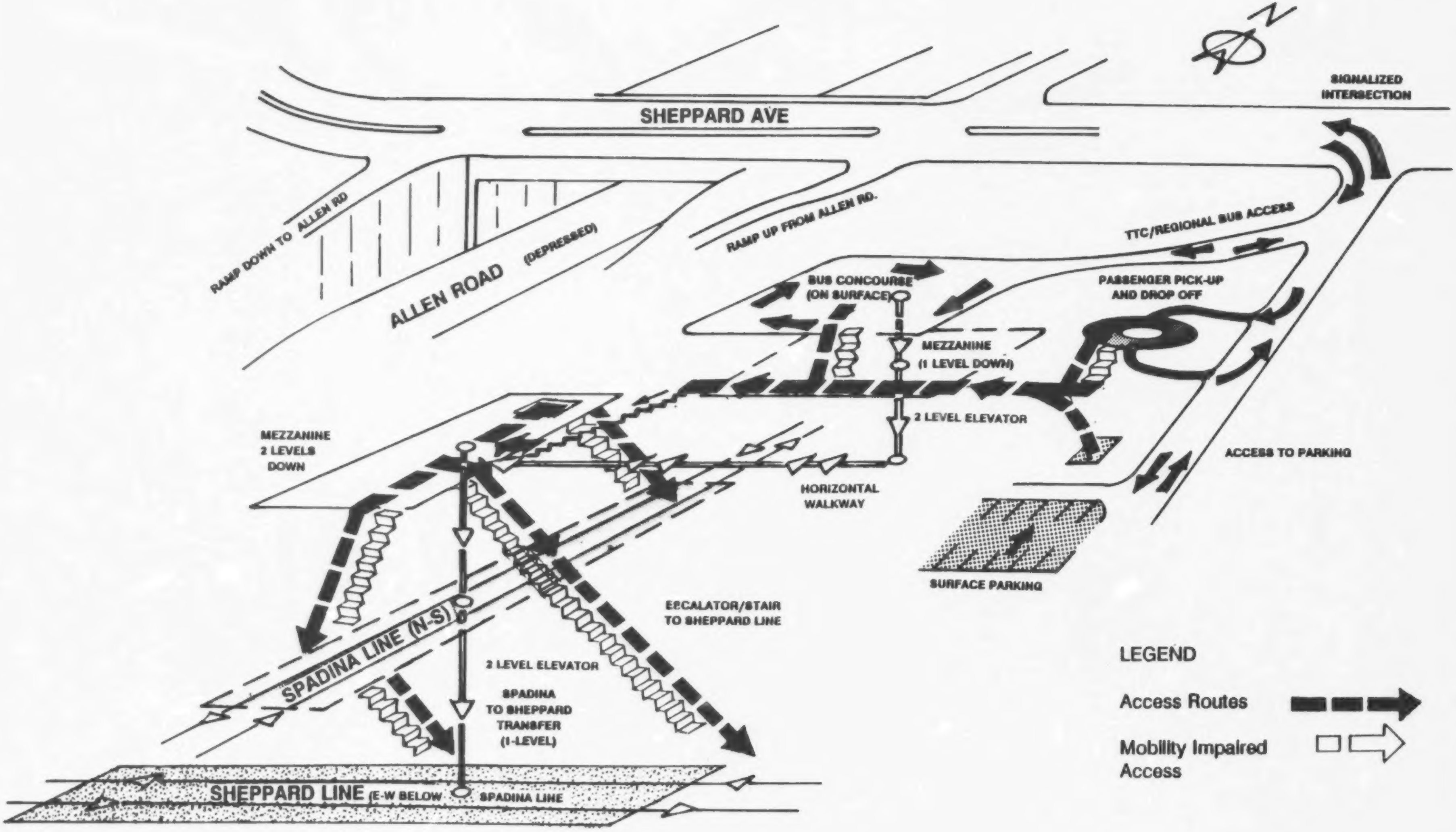
This cross-station layout aims to minimize both the horizontal and vertical distances subway patrons are required to walk. To achieve this, the four levels of the station complex are located as near as possible vertically above one another with the two lowest levels, the platforms forming the "cross" configuration. This arrangement permits:

- access by single escalators and stairs directly from the bus concourse on the surface to all Spadina and Sheppard line platforms;
- access for the mobility impaired by a bank of elevators serving all levels and platforms; and,
- convenient transfer between subway lines since platforms cross almost symmetrically.

Surface facilities such as the bus loop, passenger pick-up and drop-off carousel and park-n-ride lot can all be arranged around the station building at convenient distances due to the size and unconstrained shape of the vacant Metro land.

Vehicle access to the site for buses and automobiles would be through a new signalized access road off Sheppard Avenue approximately 220 metres east of the Sheppard Avenue/Allen Road intersection. While this shared auto and bus access is not ideal from a transit operations viewpoint, it is difficult to develop separate access points on this site. Timing of the signal phases will be set to minimize the impact of station terminal traffic on projected background traffic, while still providing good access for transit vehicles. In addition it will be necessary to construct an extra eastbound lane on the south side of Sheppard Avenue between Allen Road and the new station entrance. This lane will separate slower moving vehicles (buses and cars) entering the station from the through lanes on Sheppard Avenue.

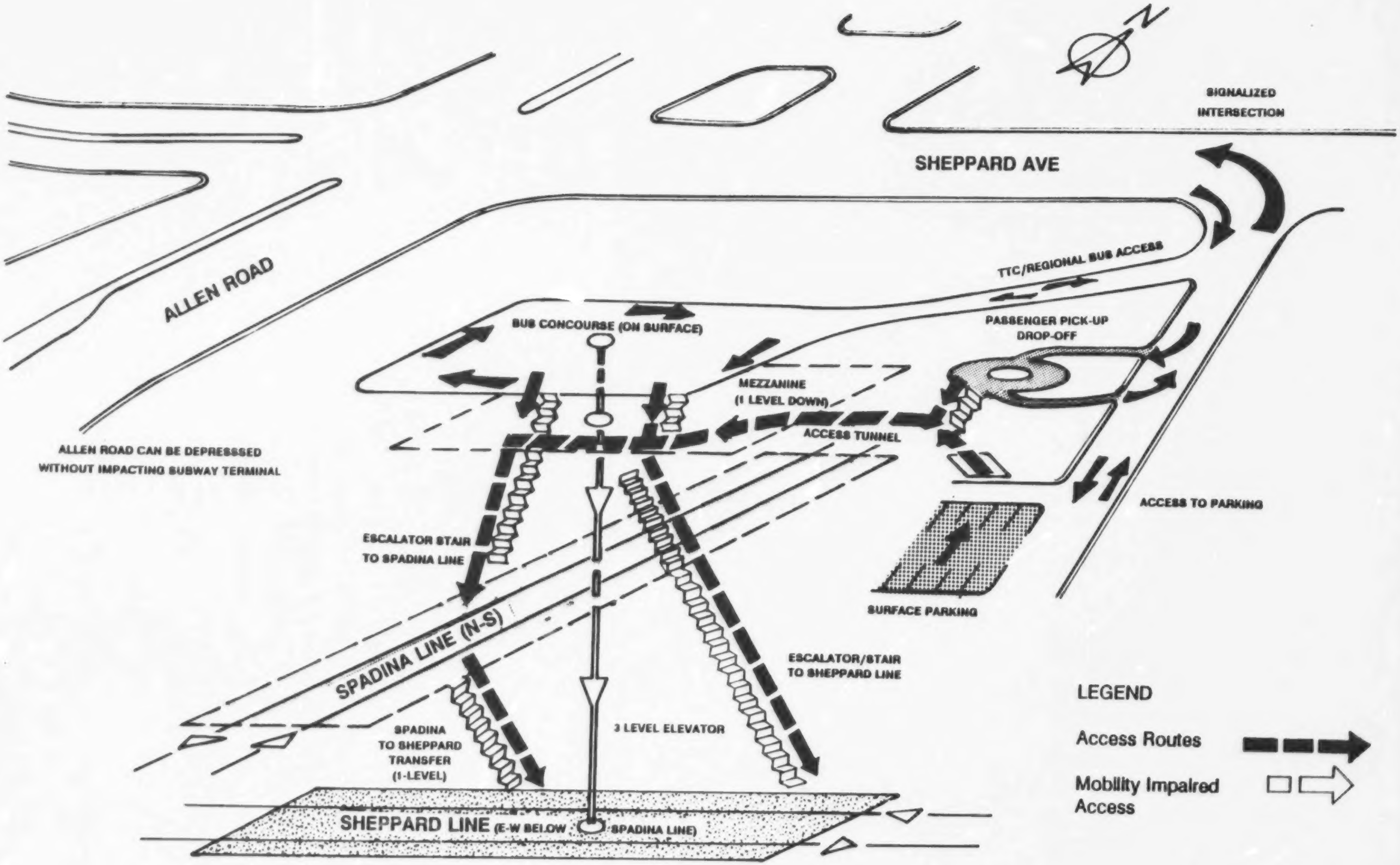
With a station in the south-east quadrant operating as the most northerly point on the Spadina subway, buses from the north would have to make a left turn from Allen Road onto Sheppard Avenue. These


SIGNALIZED INTERSECTION
N
SHEPPARD AVE
RAMP DOWN TO ALLEN RD
ALLEN ROAD
(DEPRESSED)
RAMP UP FROM ALLEN RD.
TTC/REGIONAL BUS ACCESS
BUS CONCOURSE (ON SURFACE)
PASSENGER PICK-UP AND DROP OFF
MEZZANINE (1 LEVEL DOWN)
2 LEVEL ELEVATOR
MEZZANINE 2 LEVELS DOWN
ACCESS TO PARKING
HORIZONTAL WALKWAY
SURFACE PARKING
ESCALATOR/STAIR TO SHEPPARD LINE
SPADINA LINE (N-S)
2 LEVEL ELEVATOR
SPADINA TO SHEPPARD TRANSFER (1-LEVEL)
SHEPPARD LINE (E-W BELOW SPADINA LINE
LEGEND
Access Routes
Mobility Impaired Access

STATION CONFIGURATION

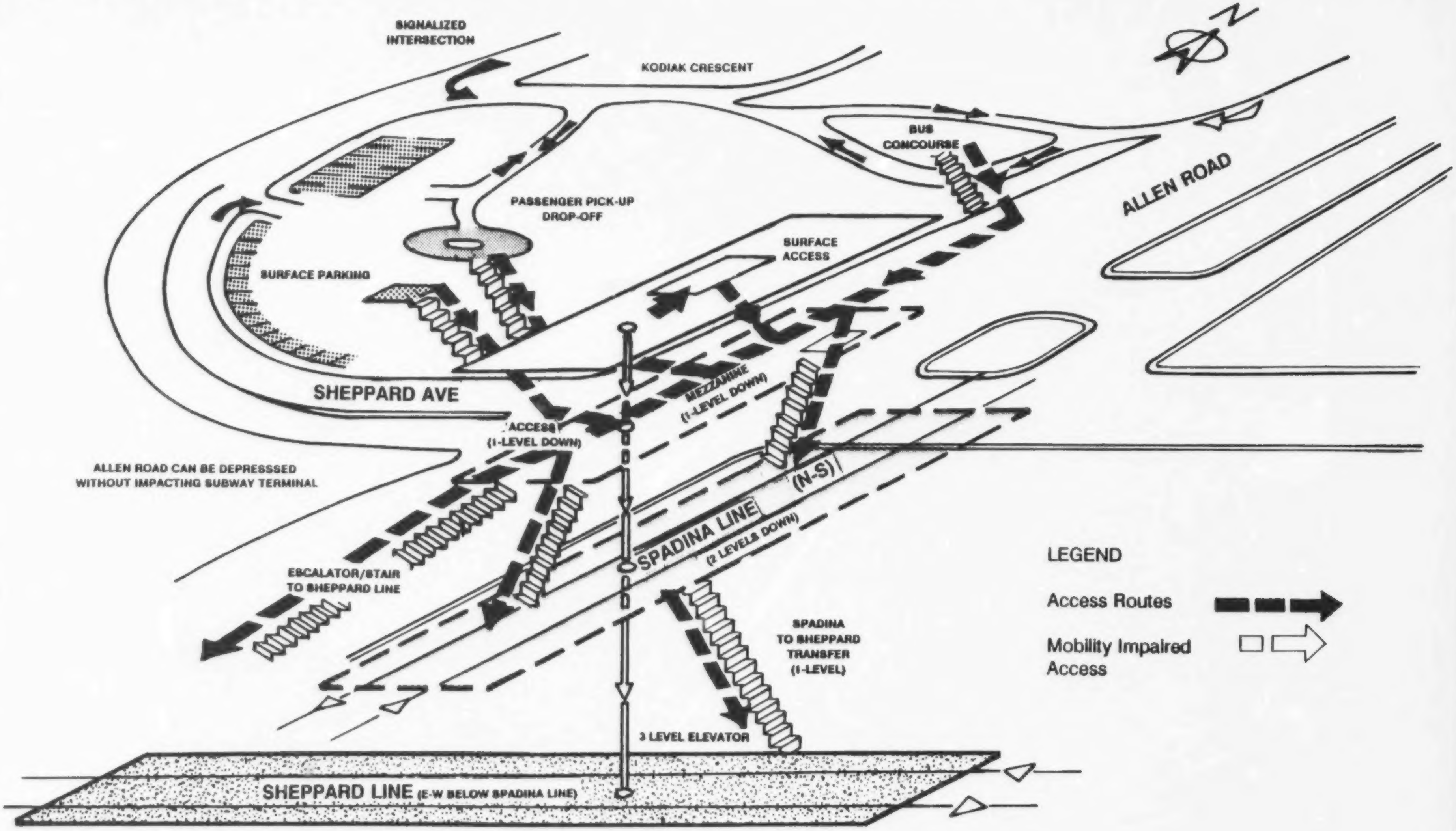
FOR ALIGNMENT A-1

EXHIBIT 6.2.1.


N
SIGNALIZED INTERSECTION
SHEPPARD AVE
ALLEN ROAD
TTC/REGIONAL BUS ACCESS
BUS CONCOURSE (ON SURFACE)
PASSENGER PICK-UP DROP-OFF
MEZZANINE (1 LEVEL DOWN)
ACCESS TUNNEL
ALLEN ROAD CAN BE DEPRESSSED WITHOUT IMPACTING SUBWAY TERMINAL
ACCESS TO PARKING
ESCALATOR STAIR TO SPADINA LINE
SURFACE PARKING
SPADINA LINE (N-S)
ESCALATOR/STAIR TO SHEPPARD LINE
SPADINA TO SHEPPARD TRANSFER (1-LEVEL)
3 LEVEL ELEVATOR
SHEPPARD LINE (E-W BELOW SPADINA LINE)
LEGEND
Access Routes
Mobility Impaired Access

STATION CONFIGURATION FOR ALIGNMENTS A-2, A-4 and A-5

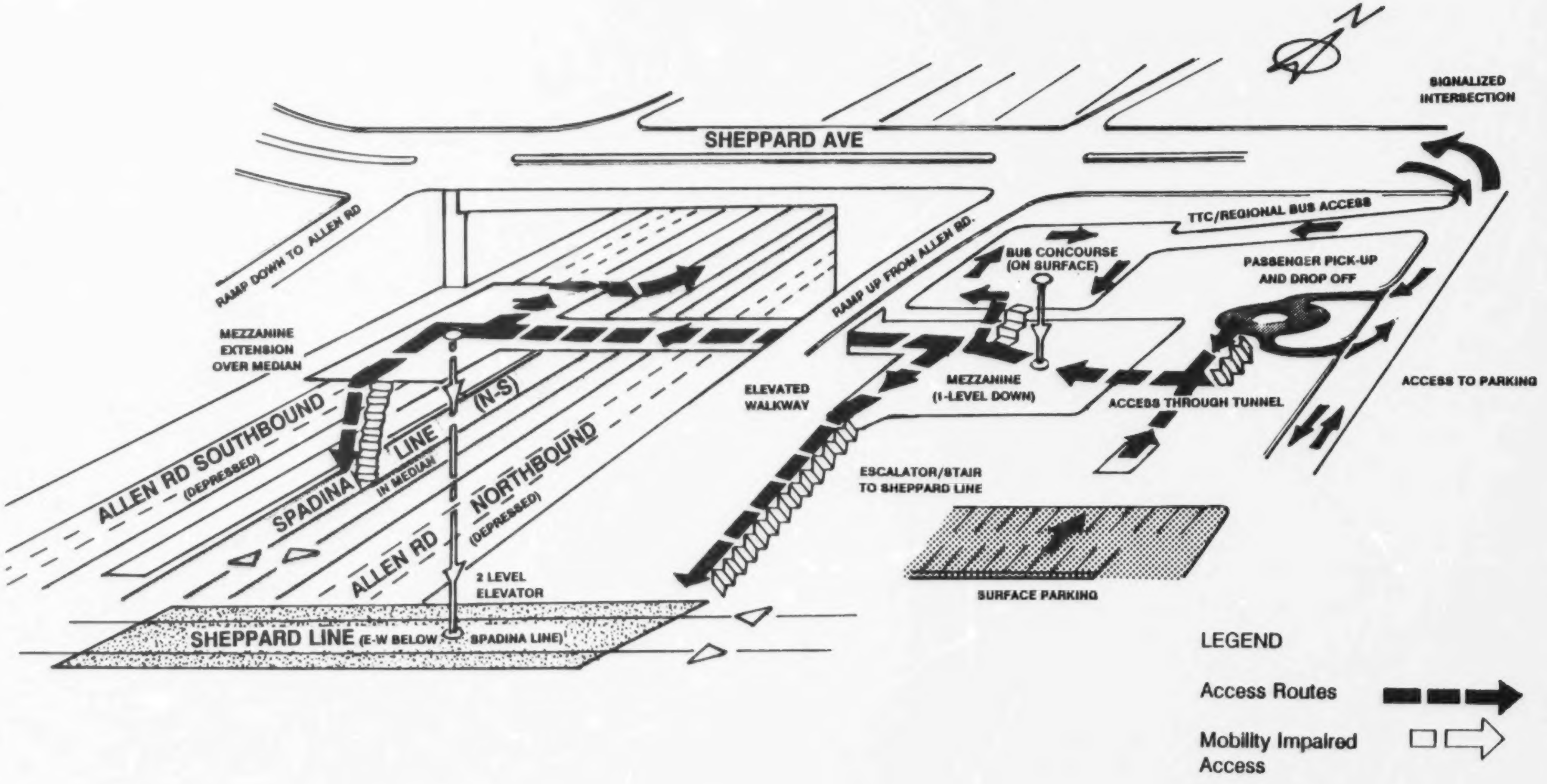
EXHIBIT 6.2.2.


SIGNALIZED INTERSECTION
KODIAK CRESCENT
BUS CONCOURSE
ALLEN ROAD
PASSENGER PICK-UP DROP-OFF
SURFACE ACCESS
SURFACE PARKING
SHEPPARD AVE
MEZZANINE (1-LEVEL DOWN)
ACCESS (1-LEVEL DOWN)
ALLEN ROAD CAN BE DEPRESSSED WITHOUT IMPACTING SUBWAY TERMINAL
(N-S)
SPADINA LINE (2 LEVELS DOWN)
ESCALATOR/STAIR TO SHEPPARD LINE
SPADINA TO SHEPPARD TRANSFER (1-LEVEL)
3 LEVEL ELEVATOR
SHEPPARD LINE (E-W BELOW SPADINA LINE)
LEGEND
Access Routes
Mobility Impaired Access

STATION CONFIGURATION

FOR ALIGNMENT A-3

EXHIBIT 6.2.3.


N
SIGNALIZED INTERSECTION
SHEPPARD AVE
RAMP DOWN TO ALLEN RD
RAMP UP FROM ALLEN RD.
TTC/REGIONAL BUS ACCESS
BUS CONCOURSE (ON SURFACE)
PASSENGER PICK-UP AND DROP OFF
ACCESS TO PARKING
MEZZANINE EXTENSION OVER MEDIAN
ELEVATED WALKWAY
MEZZANINE (1-LEVEL DOWN)
ACCESS THROUGH TUNNEL
ALLEN RD SOUTHBOUND (DEPRESSED)
SPADINA LINE IN MEDIAN (N-S)
ALLEN RD NORTHBOUND (DEPRESSED)
ESCALATOR/STAIR TO SHEPPARD LINE
SURFACE PARKING
2 LEVEL ELEVATOR
SHEPPARD LINE (E-W BELOW SPADINA LINE)
LEGEND
Access Routes
Mobility Impaired Access

STATION CONFIGURATION
FOR ALIGNMENT A-6

EXHIBIT 6.2.4.

bus movements, along with the other traffic turning left, cannot be accommodated without significant impact on the operation of the Sheppard Avenue/Allen Road intersection. To minimize these impacts, it is proposed that southbound buses on Allen Road will be re-routed via Combe Avenue and Wilson Heights Boulevard to Sheppard Avenue. Extension of the subway further north from Sheppard Avenue would eliminate the need for these buses from the north thus alleviating the left turn congestion at the Sheppard Avenue/Allen Road intersection.

The station layout described above could be implemented with provision for a grade separation of Sheppard Avenue and Allen Road. The only consequence would be that grade separation ramps would be slightly closer to the station terminal entrance than the present at-grade intersection.

Cross-station for Alignment A-1:

This layout utilizes the same arrangement of surface facilities and vehicular access described previously for alignments A-2, A-4 and A-5. A mezzanine area would again be required one-level below the surface. This area would be split into the typical fare paid and unpaid areas, the latter serving the access tunnels from sidewalks, passenger pick-up and drop-off and park-n-ride. Since the Spadina line platforms must be offset to the west for this option, all patrons transferring from buses to the Spadina subway must pass through the mezzanine area. An elevator to take mobility impaired patrons to the level of the secondary mezzanine would also be needed.

To link the mezzanine area with the platforms of both lines, a walkway to the west including a bank of escalators and stairs is needed to reach a secondary mezzanine area vertically above the platforms. From this point, escalators and stairs access all station platforms. Mobility-impaired patrons are required to traverse the horizontal walkway bypassing escalators to get to a second bank of elevators serving the two levels of platforms of both lines.

The platform elevations proposed for this station will permit construction of a grade separation of Sheppard Avenue and Allen Road with the latter depressed.

Cross-station for Alignment A-6.

Once again, this station utilizes the same arrangement of surface facilities and vehicular access from Sheppard Avenue as previously described i.e. the southeast quadrant. The main mezzanine area is located directly below the bus concourse with one-level escalator/stair and elevator access linking the two components. A direct escalator/stair access to a future Sheppard line is possible from the mezzanine area. As the Spadina line platforms would be in the median of a depressed Allen Road, it will be necessary for all patrons using this line to transfer horizontally to access a secondary mezzanine extension located above the Allen Road median. This 100 metre long transfer would include a covered elevated walkway over the northbound lanes of Allen Road.

The mezzanine extension provides access to all platforms of both Spadina line and a future Sheppard line in banks of escalators and stairs. An elevator serving both platform levels would also be needed for mobility impaired access. Transfer between subway lines is less convenient in this option because the traffic lanes adjacent to the platform structure constrain the layout of escalators and stairs to make the vertical transfer.

Parallel station for Alignment B-2

This station layout is based on the "parallel" station configuration since, at the station site for Alignment B-2, both Spadina and future Sheppard line tracks are parallel and one above the other in a north-south direction.

The layout of the surface facilities for this station type arises from the need for the platforms to be located a significant distance from the Sheppard Avenue/Allen Road intersection. Consequently the bus concourse and loop is offset to the north of the platforms and mezzanine area one-level down. Also, the passenger pick-up and drop-off carousel and park-n-ride lots are located to the north of the station. Nevertheless, this option still requires a lengthy access road from Sheppard Avenue commencing at a new signalized intersection adjacent to the existing Post Office. The total off-street distance all feeder buses must travel to serve this station option is 920 metres resulting in longer trip times on all routes.

The internal station layout of escalator/stairway banks emerges as an easily understood convenient flow from north to south with few direction changes. Direct access from the surface bus concourse to all platforms is possible and separate from the facilities and route used by patrons from the park-n-ride and carousel access tunnels. These patrons would pass through the mezzanine area where fare collection would take place.

Access for the mobility-impaired is possible by a single bank of elevators serving all three below-ground levels and all platforms of both lines.

Parallel station for Alignment B-1:

This station configuration, also in the southeast quadrant, is similar in surface layout to that described for alignments A-2, A-4 and A-5. The primary difference occurs below ground where the Spadina line alignment is parallel to the future Sheppard line, both being in an east-west direction.

Access to the platforms from the bus concourse can be direct on banks of escalators and stairs inclined to the east. Parallel to these banks would be additional escalators and stairs linking the mezzanine level to each platform. The mezzanine area would be located slightly east of the bus concourse to accommodate escalator spacing but would still have sufficient overlap to allow a single bank of elevators to pass through all four levels of the station. Access for park-in-ride and passenger pick-up/drop-off patrons would be through tunnels from south and east of the mezzanine entering an unpaid area at the east end of the mezzanine floor. A tunnel for walk-in patrons from the north sidewalk of Sheppard Ave. can also be accommodated.

6.2.2. Description of Alternative in North-west quadrant

Cross-station for Alignment A-3

Located in the northwest quadrant of the intersection, this station is also a "cross-station" configuration in that a future Sheppard subway line would pass under the north south Spadina subway line slightly north of Sheppard Avenue and approximately perpendicular to it.

The layout of this station aims to accommodate all surface and underground facilities on the 4.5 hectare privately owned vacant land west of Allen Road and north of Sheppard Avenue. The Spadina line platforms would be located along the eastern edge of the property towards the south-east corner. To achieve the shortest distance to the platforms, the mezzanine area would be located one-level down immediately above the platforms. Fare collection would again take place at this level through a north-south barrier on the west side of the area.

Passenger pick-up and drop-off facilities and park-n-ride lots would be located west of the station with convenient access to the west side of the mezzanine. Commuter parking could be provided on the surface or incorporated underground into commercial development on the site. Private automobile access would be mainly from Kodiak Crescent on the west side of the property supplemented by a right-in/right-out entrance from Sheppard Avenue.

The bus concourse would be located along the north-east edge of the station site with access to the platforms through a bank of escalators and stairs leading to the mezzanine area at its north end. For buses accessing from the Kodiak Crescent/Sheppard Avenue intersection, the total return travel distance from Sheppard Ave. would be 1,060 metres.

Access to the station for most feeder buses would be from Kodiak Crescent. Buses approaching from the north would enter the station site directly from the reserved bus lane on Allen Road north of the Sheppard Avenue/Allen Road intersection.

Buses destined for Allen Road north of Sheppard Avenue would be routed via Kodiak Crescent, Whitehorse Road and Steeprock Drive to reduce the volume of left turn movements from Kodiak onto Sheppard Avenue and at the Sheppard Avenue/Allen Road intersection. These movements would be heavy in the p.m. peak due to exiting park-n-ride vehicles.

To achieve acceptable levels of service through the intersections, the following improvements to roads surrounding the station site will be necessary:

- addition of a westbound lane on Sheppard Avenue from Allen Road to Kodiak Crescent. East of the right-in/right-out station entrance this lane would be exclusively for traffic entering the station while west of the entrance it would provide weaving distance for traffic exiting from the station.

- widening of Kodiak Crescent to four lanes at the Sheppard Avenue intersection to provide three exiting lanes (one left turn, one right turn and one through and right turn) and one lane entering Kodiak Crescent. The need for a second entering lane may also arise from detailed analysis.

Access to the station for walk-in patrons would be possible through below-ground tunnels crossing Allen Road from the east and Sheppard Avenue from the south.

6.3 Parking at the Sheppard/Allen Station

It is anticipated that the station at Sheppard Avenue will change its function as the subway network expands in North Metro. Initially, the station will operate as the terminal of the Spadina line. During this period the station will complement the park-n-ride facilities at the existing Wilson Station and will offer the most northerly and westerly access point to the subway for park-n-ride patrons. Ridership source studies indicate that, in this role, up to 1000 parking spaces could be required on the station site.

When the proposed extension north of Sheppard Avenue is implemented, the Sheppard/Allen Station will revert to the role of a line station. Assuming that development of park-n-ride facilities is feasible at stations further north, parking space needed at the Sheppard/Allen will decline to that required by patrons accessing by car from the west and those from local neighbourhoods. For this scenario, the demand for parking spaces is likely to be in the 300-600 range.

It is envisaged that the property for the extra parking spaces required in the short term would become available for other approved land-use if the demand is redistributed to other facilities further north as expected.

6.4 Service Connections

In developing the eight alternatives described, the need to provide connecting tracks to move trains in and out of service has been considered. Connections have been developed both for the initial phase when only an extended Spadina line is operating and subsequent phases when a loop to the Yonge subway or a Sheppard line is also in service.

For an extended Spadina line, service connections consist of existing or new cross-overs located within the limits of the existing mainline tracks on the east side of Wilson Yard. In all cases, connections would be available at both the south and north ends of the yard and would be configured to permit parallel moves. At the north end of the yard a central pocket track to store two six-car trains and linked to both mainlines, is included in all alignments passing through the yard.

These simple connections are not feasible for Alternatives 'A-4' and 'A-6' which would require separate service tracks across Allen Road to link the mainlines on the east side of Allen Road, or in its median, with the Wilson Yard. At the south end of Wilson Yard only a single service track, passing under Allen road and the southbound mainline is feasible. This track would lead to a central pocket track linked to both mainlines.

Provision of connections to move trains in and out of service on a future Sheppard line, or a loop to the Yonge line requires construction of new, separate service tracks from Wilson Yard or the possible Allen Yard east of Allen Road. These connecting tracks would start at the yard limits and where possible follow mainline alignments to minimize construction costs.

7.0 EVALUATION OF SUBWAY ALIGNMENT ALTERNATIVES

7.1 Evaluation Methodology

The preceding Section of this report has provided a detailed technical description of each of the eight alternative alignments under consideration, as a basis for assessing their relative merit from an environmental perspective.

In order to ensure that the methodology for evaluation of the alternative alignments satisfies Ontario Ministry of the Environment's requirements, the Interim Guidelines on Environmental Assessment Planning and Approvals have been consulted. They provide a useful context for undertaking the evaluation process:

- Environmental criteria used to evaluate alternatives "should include all components of the environment specified by the Act...social, cultural, technical, economic and natural..."

- Reasons for selecting the criteria should be clearly defined and explained.

- Effects can be positive or negative, direct or indirect...Both positive and negative environmental effects should be presented in the EA to provide a balanced picture of the likely environmental effects.

- Where the proponent determines that one or more components of the environment will not be affected, this conclusion, as well as the way in which it was reached, must be documented.

The evaluative process developed for this proposed undertaking incorporates these guidelines and is described below:

1. A series of **evaluative criteria** were developed over a period of months, in consultation with the Technical Working Committee. Effort has been made to ensure that all components of the environment specified by the Act have, indeed, been considered. These criteria fall under five main areas, namely I) transportation, II) social environment, III) bio-physical environment, IV) land use; and V) cost. They are discussed in detail in Section 7.2 of this Assessment.

2. Each of these criteria has been examined against all of the eight alternative alignments; this analysis has been summarized on a series of matrices, supplemented by text. (See Section 7.3).

3. A **comparative evaluation** has then been carried out to characterize the relative merit of each alternative alignment with respect to these criteria. A four-tiered hierarchical ranking system has been used. Since in some cases evaluation of the criteria has related to **performance** of the alignment and in others, **impact** on the environment, this four-tiered ranking system uses two scales, as described below:

	Performance Scale		Impact Scale
-	Very good (VG)	- equivalent to:	No impact (N)
-	Good (G)	- equivalent to:	Low impact (L)
-	Fair (F)	- equivalent to:	Moderate impact (M)
-	Poor (P)	- equivalent to:	High impact (H)

This approach has been developed to enable identification of the extent and relevance of differences among the alignments in terms of their environmental impacts. The following guidance is provided by the Ontario Ministry of Environment through its Interim Guidelines on Environmental Assessment Planning and Approvals:

> "In many cases, choosing between alternatives is the most difficult part of planning. In choosing methods for predicting net environmental effects and evaluating advantages and disadvantages, proponents are advised to select methods which will clearly identify relative differences and key impacts to make the trade-offs involved in selecting the undertaking clear."

4. Where rankings for certain criteria have proven to reveal little or no difference among the alternative alignments, these criteria have been discussed in the text, but screened out of the comparative ranking analysis. The focus of the comparative analysis has been to identify relative differences and to make the trade-offs clear.

5. Rankings were analyzed and two alignments emerged as being better than the remaining six, and very similar in their relative merit. The trade-offs and impacts associated with each of the two alternatives were more closely examined, to determine whether either one of them could be identified as being the preferred alternative. These trade-offs and impacts were highlighted and recommendations developed. (See Section 8.0)

The findings of the analyses reflected in the five step process above are found in the remaining parts of this Section.

7.2 Assessment Factors

Criteria to evaluate the relative merit of the alternative alignments were developed through an iterative process with the consultant and the Technical Working Committee. The aim of this process was to ensure that all areas of possible environmental impact were identified and incorporated into the analysis.

The criteria have been framed within a hierarchical structure, composed of a series of "Factors", "Sub-factors" and "Indicators", where:

- **Factors** represent the primary environmental components specified by the Act, under which more detailed evaluative criteria have been established;
- **Sub-factors** are "sub-sets" of the Factors. They are evaluative criteria, falling under the environmental area defined by the Factor, and are applied to assess impacts, advantages, disadvantages and differences among alignments under consideration;
- **Indicators** are the specific elements of the Sub-factors which are used to reflect the differences among the alignments; and allow a ranking to be assigned to each.

For each indicator, means of measuring and specifying the degree to which alignments differ from each other were derived.

As can be seen, there are **five Factors** which have been considered, namely:

I:	Transportation
II:	Social Environment
III:	Bio-physical Environment
IV:	Land Use
V:	Cost

7.2.1 Criteria for Evaluation of Alignment Alternatives

In this section definitions have been provided, falling under the primary Factors, to enable the reader to better understand areas requiring specialized technical knowledge (see Table 7-1). The Indicators which have been used to evaluate alignments against each Sub-factor are also provided. The results of the analysis arising from use of this framework are described in Sections 7.3 and 7.4, following.

TABLE 7.1
Criteria For Evaluation of Alignment Alternatives

Sub-Factor	Definition
Factor 1: Transportation	
A. Mainline Track Alignment (Design Geometrics)	Evaluation of ride comfort, operating speed and impact on levels of track maintenance.
B. Convenience of Service Connections	Evaluation of ability to link mainlines to existing yard to bring subway vehicles into and out of service.
C. Efficiency of New Sheppard/Allen Terminal Operations	Evaluation of how the physical configuration of terminal facilities affects the TTC's ease of operation.
D. External Accessibility of Sheppard/Allen Terminal	Evaluation of access to the terminal by TTC patrons
E. Internal Terminal Circulation	Evaluation of ease of terminal use by TTC patrons
F. Flexibility for Expansion of Network	Evaluation of the physical/design capability of the alternative to accommodate multi-directional transit network expansion.
G. Impact on Immediate Study Area Road Network	Evaluation of impact on traffic volumes and patterns resulting from terminal activities (buses, park-n-ride, etc.)
H. Failure Management Capability	Evaluation of the ability of track configuration (mainline, service connections, storage tracks, etc.) to respond to unforeseen operational difficulties.

TABLE 7.1
Criteria For Evaluation of Alignment Alternatives

Sub-Factor	Definition
Factor II: Social Environment	
A. Construction	Evaluation of effects of construction on people within the immediate Study Area.
B. Vibration	Evaluation of impact of subway-generated vibrations on sensitive receptors.
C. Predicted Noise (Operation)	Evaluation of long term noise effect of operation on sensitive receptors.
D. Electromagnetic Interference (EMI)	Evaluation of EMI effects of subway operation on sensitive receptors.
E. Air Quality	Evaluation of effect of terminal operations on air quality.
F. Visual Impact	Evaluation of visual impact on sensitive receptors.
G. Safety	Evaluation of the potential for accidents during subway and terminal operations
H. Security	Evaluation of potential for interference to persons or property by criminal acts.
I. Heritage/Archaeology	Evaluation of potential for impact on heritage or archaeological features or sites.
Factor III: Biophysical Environment	
A. Contaminated Soils	Evaluation of need to remove and safely dispose of soil at registered disposal area.
B. Soil Erosion	Evaluation of potential for soil erosion.
C. Runoff/Drainage	Evaluation of potential to transport sediment or pollutants to local river system.

TABLE 7.1
Criteria For Evaluation of Alignment Alternatives

Sub-Factor	Definition
Factor IV: Land Use	
A. Consistency with Planning Policies.	Evaluation of alignment for consistency with stated planning policies of government jurisdictions.
B. Immediate Impact on Adjacent Properties	Evaluation of the effect of the undertaking on the existing use of adjacent properties.
C. Impact on Future Land Uses	Evaluation of the impact of alignments on the future use of lands within the immediate Study Area.
Factor V: Cost	
A. Property Acquisition	Evaluation of the costs associated with property acquisitions required for the alignment and terminal.
B. Construction	Evaluation of the costs of construction associated with the alternative.
C. Operation and Maintenance	Evaluation of the costs associated with operating the service and maintaining the infrastructure.
D. Future Expansion	Evaluation of the construction costs which would be associated with future expansion options.

7.3 Evaluation of Alignment Alternatives

7.3.1 Introduction

In Section 6, the eight alignment alternatives were described at length with respect to their technical and design characteristics. These descriptions, together with the analysis of existing conditions, have provided the basis for evaluation of the alternatives.

To ensure a comprehensive examination of the environmental impact of all of the alignment alternatives, each has been analyzed against the Factors, Sub-factors and Indicators (described in Section 7.2) to identify the impacts which can be expected to arise and/or the level of performance which the alignment provides. Thus, for example, while a sub-factor such as Security or Safety would lend itself to a performance-based assessment ("How well would the alignment alternative provide for the security and safety of patrons?"), a sub-factor such as noise level would require an impact-based assessment.

The results of this analysis are summarized in Table 7-2, following and discussed in some detail later in this Section. As noted in Section 7.1, a subjective ranking of the alignment alternatives has been applied to characterize the extent of difference among the options. The ranking system makes four levels of distinction and has parallel performance and impact-based scales, but does not make a subjective judgment to "weigh" any one criterion as being more important than another.

It should be noted that **Appendix 7.3 contains a detailed description of the rationale for the ranking assigned to each Alignment.**

7.3.2 Factor I: Transportation

A. Mainline Track Alignment (Design Geometrics)
B. Convenience of Service Connections
C. Efficiency of New Sheppard/Allen Terminal Operations
D. External Accessibility of Sheppard/Allen Terminal
E. Internal Terminal Circulation

TABLE 7-2
RANKING OF ALTERNATIVES

EVALUATION OF ALTERNATIVES: FACTOR I: TRANSPORTATION									
Sub-Factors	A-1	A-2	A-3	A-4	A-5	A-6	B-1	B-2	CONCLUSIONS
A. Mainline Track Alignment (Design Geometrics)	Evaluation of ride comfort, operating speed and impact on levels of track maintenance.								
Horizontal geometry	G	VG	G	VG	F	VG	P	G	Alignment A-2 is ranked best because it has minimum curvature and an almost flat, uniform track grading hence it has the highest potential to achieve good ride comfort, maximize operating speed and reduce track maintenance. The quality of alignment A-3 is considered to be only slightly lower.
Vertical profile	G	VG	VG	F	VG	F	VG	G	
Terminal track work	All alignments incorporate the desired terminal trackwork.								
Sub-Total	2G	2VG	1VG, 1G	1VG, 1F	1VG, 1F	1VG, 1F	1VG, 1P	2G	
Sub-Factor Ranking	3	1	2	4	4	4	5	3	
B. Convenience of Service Connections	Evaluation of ability to link mainlines to existing and future yards, to bring subway vehicles into and out of service.								Alignments A-1, A-2, A-3, A-5 and B-2 are ranked best because they offer the most convenient connections to the existing Wilson Yard, since mainlines in these alternatives pass through the yard property.
To existing Wilson yard	G	G	G	F	G	F	F	G	
Sub-Total	1G	1G	1G	1F	1G	1F	1F	1G	
Sub-Factor Ranking	1	1	1	2	1	2	2	1	
C. Efficiency of New Sheppard/Allen Terminal Operations	Evaluation of how physical configuration of terminal facilities affects TTC's ease of operation.								The operational efficiency of the terminal facility from the operator's perspective (TTC) is similar for both south-east and north-west quadrant locations. Minor differences in individual components offset one another leaving alternatives A-2, A-3, A-4 and A-5, ranked best. Alignments with stations below Allen Road (A-1) or within its median (A-6) have more elements to control and maintain resulting in less efficiency.
On-site bus operation	F	F	G	F	F	F	F	P	
Passenger pick-up/drop-off facilities	G	G	F	G	G	G	G	F	
Park 'n' ride facilities	G	G	G	G	G	G	G	F	
Station facilities	F	VG	VG	VG	VG	F	G	G	
Sub-Total	2G, 2F	1VG, 2G, 1F	1VG, 2G 1F	1VG, 2G, 1F	1VG, 2G, 1F	2G, 2F	3G, 1F	1G, 2F, 1P	
Sub-Factor Ranking	3	1	1	1	1	3	2	4	

TABLE 7-2
RANKING OF ALTERNATIVES

EVALUATION OF ALTERNATIVES: FACTOR I: TRANSPORTATION

Sub-Factors	A-1	A-2	A-3	A-4	A-5	A-6	B-1	B-2	CONCLUSIONS
D. External Accessibility of Sheppard/Allen Terminal	Evaluation of ease of access to the terminal by TTC patrons.								Alignment A-3 is ranked best for overall external accessibility to TTC patrons because: • the majority of feeder bus services approach from the north and west and are able to enter the terminal through a single intersection or direct right-in access. • automobile access, although partially shared with buses and remote from Allen Road, is as convenient as a south-east quadrant terminal. • convenient walk-in access separated from vehicles is feasible from all quadrants of the Sheppard/Allen intersection. Alignment A-2, with a terminal in the south-east quadrant is ranked lower because bus access is more dependent on traffic flow through three intersections.
TTC and regional bus access	F	F	G	F	F	F	F	P	
Auto access	F	F	F	F	F	F	F	P	
Pedestrian access	G	G	G	G	G	G	G	P	
Sub-Total	1G, 2F	1G, 2F	2G, 1F	1G, 2F	1G, 2F	1G, 2F	1G, 2F	3P	
Sub-Factor Ranking	2	2	1	2	2	2	2	3	
E. Internal Terminal Circulation	Evaluation of ease of terminal use by TTC patrons.								Consideration of the terminal configuration and internal circulation patterns for each type of subway patron reveals that alignments A-2, A-4, A-5 and B-1 are ranked best because they incorporate a south-east quadrant terminal which offers more direct and convenient access. Alignment A-3 is ranked marginally lower because the layout necessary compromises bus-subway and subway-subway transfers slightly.
a) Access for mobility impaired	F	VG	VG	VG	VG	F	VG	VG	
b) Access from park 'n' ride	F	G	VG	G	G	F	G	G	
c) Access from passenger pick-up/drop-off	F	G	G	G	G	F	G	F	
d) Pedestrian access	F	G	G	G	G	F	G	G	
e) Bus - subway transfers	F	G	F	G	G	F	G	F	
f) Subway - subway transfers	G	G	F	G	G	P	VG	VG	
Sub-Total	1G, 5F	1VG, 5G	2VG, 2G, 2F	1VG, 5G	1VG, 5G	5F, 1P	2VG, 4G	2VG, 2G, 2F	
Sub-Factor Ranking	4	2	3	2	2	5	1	3	

TABLE 7-2
RANKING OF ALTERNATIVES

EVALUATION OF ALTERNATIVES: FACTOR I: TRANSPORTATION

Sub-Factors	A-1	A-2	A-3	A-4	A-5	A-6	B-1	B-2	CONCLUSIONS
F. Flexibility for Expansion of Network	Evaluation of the physical/design capability of the alternative to accommodate multi-directional transit network expansion.								Alignment B-2 is ranked best since it offers the greatest flexibility for expansion of the subway network in all directions because the more southerly location of the Sheppard/Allen station allows convenient extension of the mainlines in an easterly, northerly, north-westerly or westerly direction. However, development of a future intermediate station on DND property results in a less desirable station spacing in the B-2 alternative. Most of the remaining alignments (A-1, A-2, A-3, A-5 and B-1) allow reasonable flexibility for further extension and generally accommodate a well-spaced extra station on DND lands.
a) Ability to add extra station	G	G	G	F	G	F	G	F	
b) Ability to expand directly northward	G	G	G	G	G	G	F	G	
c) Ability to expand northwestward	F	F	F	F	F	F	F	G	
d) Ability to expand eastward	F	F	F	F	F	F	G	G	
e) Ability to expand westward	G	G	G	G	G	G	G	G	
f) Ability to connect to future yard	G	G	F	G	G	F	F	G	
Sub-Total	4G, 2F	4G, 2F	3G, 3F	3G, 3F	4G, 2F	2G, 4F	3G, 3F	5G, 1F	
Sub-Factor Ranking	2	2	3	3	2	3	2	1	
G. Impact on Immediate Study Area Road Network	Evaluation of impact of traffic volumes and patterns resulting from terminal activities (buses, Park 'n' ride, etc.)								Alignment A-3 is ranked best because it incorporates the north-west quadrant terminal location which will minimize the traffic impact on existing roads. This is due to more efficient feeder bus accessibility along with reduced impact on the already overloaded Sheppard/Allen intersection. In common with most other alternatives, A-3 is also compatible with the road widening and grade separation options being protected in the station terminal area.
a) Existing road network	M	M	L	M	M	L	M	M	
b) Future road network	L	L	L	L	L	M	L	L	
Sub-Total	1M, 1L	1M, 1L	2L	1M, 1L	1M, 1L	1L, 1M	1M, 1L	1M, 1L	
Sub-Factor Ranking	2	2	1	2	2	3	2	2	
Factor Totals									
VG/NI	-	4VG	4VG	3VG	3VG	1VG	3VG	2VG	Alternative A-2 emerges as the best performing alignment from overall transportation considerations, having good quality track geometry, convenient service connections to yards and a station terminal providing good internal circulation. However alignment A-3, almost equal in overall ranking, offers better feeder bus access and a lower impact on traffic in the study area.
G/L	11G/L	13G/L	13G/L	11G/L	13G/L	5G	12G/L	11G/L	
F/M	13F/M	7F/M	7F/M	10F/M	8F/M	16F/M	8F/M	7F/M	
P/H						2P/H	1P	4P	
OVERALL FACTOR RANKING	7	1	2	5	3	8	4	6	

F. Flexibility for Expansion of Network

G. Impact on Immediate Study Area Road Network

H.[1] Failure Management Capability

Factor I

Sub Factor A: Mainline Track Alignment

The assessment of the mainline track design geometrics, both horizontal and vertical, provides an evaluation of the ride comfort, operating speed and level of track maintenance which can be expected from each alignment alternative. As stated in Section 6, all alignments meet the minimum geometric standards required by the Toronto Transit Commission for Subway design. Hence, the evaluation of alignments involves a comparison of the degree by which track geometry exceeds minimum levels and the proportion of the total length of track where minimum standards are required.

In assessing a ranking for **horizontal geometry,** the straightness of the mainlines is the primary criterion since greater curvature in an alignment reduces ride comfort, constrains operating speed and increases track maintenance. On this basis, Alignments A-2, A-4 and A-6 perform best against this indicator, being mostly straight or in the case of A-6 having minimal curvature following the Allen Road median. While Alignments A-1, A-3 and B-2 are ranked lower, they still incorporate reasonable design standards yielding very satisfactory operating characteristics.

Alignments A-5 and B-1, while meeting absolute minimum standards, both require extensive sections with excessive curvature to achieve the design objectives. This curvature will have a marked effect on ride comfort, limited operating speed and significantly increase track maintenance. Hence these horizontal alignments are the least desirable and are ranked lowest.

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[1] It should be noted that Sub-Factor H has been eliminated from Table 7.2 and from the rankings, as little difference was found to exist among the alignment alternatives. The alignments' performance with respect to this Sub-factor is discussed in absolute terms in the text of this Section.

The evaluation of the second element of mainline alignment, the **vertical profile** is derived from the degree to which the alignment alternatives minimize track grade (slope) and rapid changes of grade (roller-coaster effect). For most alternatives, the vertical profile achievable can be ranked good or very good, since generally, grades are near minimum (almost flat) and major grade changes are not required. Exceptions are Alignments A-4 and A-6 which require sections at or near maximum grade to pass over the existing service connection tracks to Wilson Yard or under the Transit Road intersection. Successive grade changes are also required in these sections.

Alignments A-2, A-3, A-5 and B-1 have the flattest most uniform profiles. This is possible because the major controlling features, viz. Wilson Yard tracks, the required depth below the CFB Toronto runway surface and Allen Road and the desirable depth at the new Sheppard/Allen station can all be linked by fairly flat, uniform grades.

As stated earlier in Section 6, all alignment alternatives incorporate an identical configuration of the terminal trackwork i.e., crossovers and tail tracks associated with the terminal station. Hence this third primary element of the mainline track geometry has not been included in the comparative evaluation.

Conclusion: Overall, **Alignment A-2 has the highest ranked mainline track geometry** followed by alignment A-3 with a slightly lower quality.

Factor I

Sub-factor B: Convenience of Service Connections

The evaluation of the ability, in each alternative, to link the mainlines to the existing Wilson yard is derived from an assessment of the configuration, complexity and operation of the tracks connecting the mainlines to yard tracks i.e., the service connections necessary to bring trains into and out-of-service.

Connections to Existing Wilson Yard:

In ranking the alternatives against this indicator, connections to both the north and south ends of the existing Wilson Yard were considered.

All alignments which pass through Wilson Yard facilitate convenient, direct connections to yard tracks and consequently are ranked highest. These include alternatives A-1 - A-3, A-5 and B-2. Although Alignment B-1 also passes through the yard, it suffers from the need for lengthy non-revenue running around the loop to take trains out-of-service from the new Sheppard/Allen Terminal, hence the ranking is lower.

Alignments A-4 and A-6, which follow the Allen Road median, by-passing the Wilson Yard eliminate one of the connecting tracks at the south end and require longer more complex connections at the north end of Wilson Yard. The opportunity for direct cross-overs onto yard receiving tracks is precluded by the median routing of these two alternatives. These considerations result in an overall lower ranking.

Conclusion: Alignments A-1, A-2, A-3, A-5 and B-2 are ranked best.

Factor I
Sub-factor C: Sheppard/Allen Terminal Operations

In order to evaluate how the physical configuration of terminal facilities affects TTC operations, an assessment of the operational efficiency of each terminal component was made from the operator's (TTC's) perspective.

Considering **on-site bus operation**, comparison of the three relevant Station Types, 'A', 'D' and 'F', influencing the ranking for this indicator, shows that Alignment A-3 offers greater efficiency. This results from the moderate distances from the terminal entrances to the bus loop and platforms. Also, the opportunity for buses from the north to access the terminal directly from Allen Road reduces the amount of unavoidable inbound/outbound conflict at the loop entrance. The remainder of the alignments require buses using a terminal on the southeast quadrant to negotiate a more circuitous route on the site.

Passenger pick-up/drop-off facilities are generally considered good for all alternatives except alignment B-2, where the control of auto access for pick-up and drop-off will be more complex, given the longer distance from Sheppard Avenue to be travelled in mixed traffic. The longer access roads will also require more TTC maintenance.

If integrated development is pursued on either of the station terminal sites, the development layout and circulation patterns will have to ensure that a accessibility for TTC patrons is not compromised.

When assessing park-n-ride facilities, most alignments offer the opportunity for efficient operation; hence they are ranked "good". The ranking of B-2 is again lowered to "fair" in view of the longer access route to control and maintain.

Assessment of station facility operational efficiency reveals that Alignments A-2, A-4 and A-5, utilizing Station Type 'A' potentially offer greater efficiency, since the number of elements (escalators, stairs, mezzanines, walkways, etc.) is minimized in a more compact facility which will be easier to control and maintain. Station types 'D', 'E' and 'F' in alignments B-2, B-1 and A-3 respectively will be only marginally less efficient and hence are ranked "good". Alignments A-1 and A-6 are ranked only "fair" because their station types require more elements and greater volume to control and maintain.

Conclusions: The operational efficiency of the terminal facility from the operator's perspective is similar for both southeast and northwest quadrant locations. Minor differences in individual components offset one another, leaving Alternatives A-2, A-3, A-4 and A-5 ranked highest.

Factor I
Sub-Factor D: External Accessibility of Sheppard/Allen Terminal

Bus access for both TTC and regional buses is ranked as only fair for the alignments with the bus terminal in the southeast quadrant and poor for Alignment B-2 where the terminal is further south and remote from Sheppard Avenue routes. The fair ranking reflects the operating complexity and delay potential with most routes having to pass through the Sheppard Avenue/Allen Road intersection as well as making left turns at the new signalized entrance to the southeast terminal on Sheppard Avenue. The local circulation time for routes from the west, which predominates, is also greater.

By comparison, Alignment A-3, which is the only alternative with a terminal in the northwest quadrant, is seen as having good accessibility performance since routes from the west avoid the major intersection and have a shorter local circulation route with a potential average trip time saving of up to 5 minutes for each bus.

Access for automobiles is also considered only fair (or poor in the case of B-2) in that in all cases the terminal access point must be kept approximately 200 metres from the Sheppard/Allen intersection. In addition it is not feasible to totally separate auto and bus access. Because, in the long term, most riders accessing the subway by automobile will likely approach from the west, **Alignment A-3 would offer more convenient access overall.**

Pedestrian access from all quadrants surrounding the Sheppard/Allen intersection is feasible with tunnels under the roadways in all alternatives except B-2. Hence all are ranked good with B-2 being poor because of its remoteness from the major intersection.

Conclusion: **Alignment A-3 provides the best overall external accessibility to the terminal due to its northwest quadrant location.**

Factor I
Sub-Factor E: Internal Terminal Circulation

The evaluation of the ease of use of the Sheppard/Allen terminal station facilities by TTC patrons entails an assessment of the configuration of the facilities and the convenience of circulation patterns for each of the following types of users:

- **the mobility impaired** for whom the southeast quadrant terminal location of Alignments A-2, A-4, A-5, B-1 and B-2 incorporates convenient direct access to all platforms and mezzanine level from a single set of elevators entered from the bus concourse. This configuration is assessed as providing maximum convenience and hence achieves the highest ranking. The northwest quadrant terminal for Alignment A-3 also achieves very good ranking as a convenient bus-subway transfer using a single elevator set to all platforms could be developed. The terminal for Alignments A-1 and A-6 is ranked lowest since these users are required to transfer between elevators and travel greater distances.

- **Park-n-ride passengers** who are generally offered convenient access from the parking area for most Alignments hence access is considered good to very good, the latter applying when direct internal access from underground parking close to the mezzanine is available. Terminals for A-1 and A-6 require longer walking distances and vertical travel in the case of Alignment A-1; hence they are ranked only fair.

- **Passenger pick-up/drop-off passengers** for whom access convenience is similar to park-n-ride patrons. Again, most alignments are ranked as good with the exception of A-1, A-6 and B-2 where access is fair as a result of greater walking distances or, in the case of B-2 greater driving distance from major arterial.

- **Pedestrians**, where again, the greater internal circulation distance required for alignments A-1 and A-6 results in their being ranked lower than the remainder, which are considered to provide good access.

- **Passengers transferring from buses**, who have good direct access through the station for Alignments A-2, A-4, A-5 and B-1. The greater internal circulation distance or vertical travel required for A-1, A-3 and A-6 reduces the ranking of these alternatives to fair. Longer on-site bus circulation needed for Alignment B-2 is the reason for this alternative also being considered only fair for bus transfer patrons.

- **Passengers transferring between subways**, are required to change trains in all A-series alignments while the possibility of continuous through trains can be achieved with Alignments B-1 and B-2; hence the latter are ranked as very good against this indicator. The median station location for A-6 and in A-3, the relationship of the intersecting alignments to a possible Sheppard/Allen grade separation, complicates the transfer resulting in poor and fair rankings respectively. The remaining four alignments all permit good transfers.

Conclusion: **The internal circulation resulting from the terminal configuration is rated highest for alignments A-2, A-4, A-5 and B-1.**

Factor I

Sub-Factor F: Flexibility for Expansion of Network

The evaluation of the physical and design capability of the alternatives to accommodate multi-directional subway network expansion is based on an assessment of the implications of expansion in each of the possible directions. The initiatives outlined recently in the Provincial Government policy statement, "Lets Move" have given greater importance to the flexibility for expansion of the subway from the terminal in this undertaking.

Expansion of access to the subway from land use changes in the study area is evaluated by assessing the feasibility and quality of a future intermediate station stop between the existing Wilson station and the new Sheppard/Allen station.

Addition of an extra intermediate station is feasible for all alternatives; however in Alignment B-2 the only possible site is at the minimum acceptable distance south of the Sheppard/Allen station. In most alternatives the future station would be located on DND property resulting in good accessibility from a future new land use adjacent to the subway should base activities be discontinued at some time in the future.

Alignment A-4 can accommodate an extra station on Metro property, although if the adjacent Metro land were utilized for a storage and maintenance yard, access to the additional station would have to be from the west side of Allen Road where DND property may become available. An extra station on Alignment A-6 would have to be located in the median immediately north of Transit Road. A widening of the median would be required to accommodate the station platforms.

The considerations described above result in a "good" ranking for Alignments A-1, A-2, A-3, A-5 and B-1 while the remaining three alignments are ranked fair.

The ability to expand directly northward to Finch Avenue, one of the options for linking the Spadina subway to the Yonge subway, is assessed as "good" for all alignments except B-1 where a complex routing from Sheppard Avenue onto Wilson Heights Boulevard is necessary to continue the subway northward. This alignment would involve significant property impacts. All other alternatives permit convenient expansion utilizing the Allen Road/Dufferin Street road allowance.

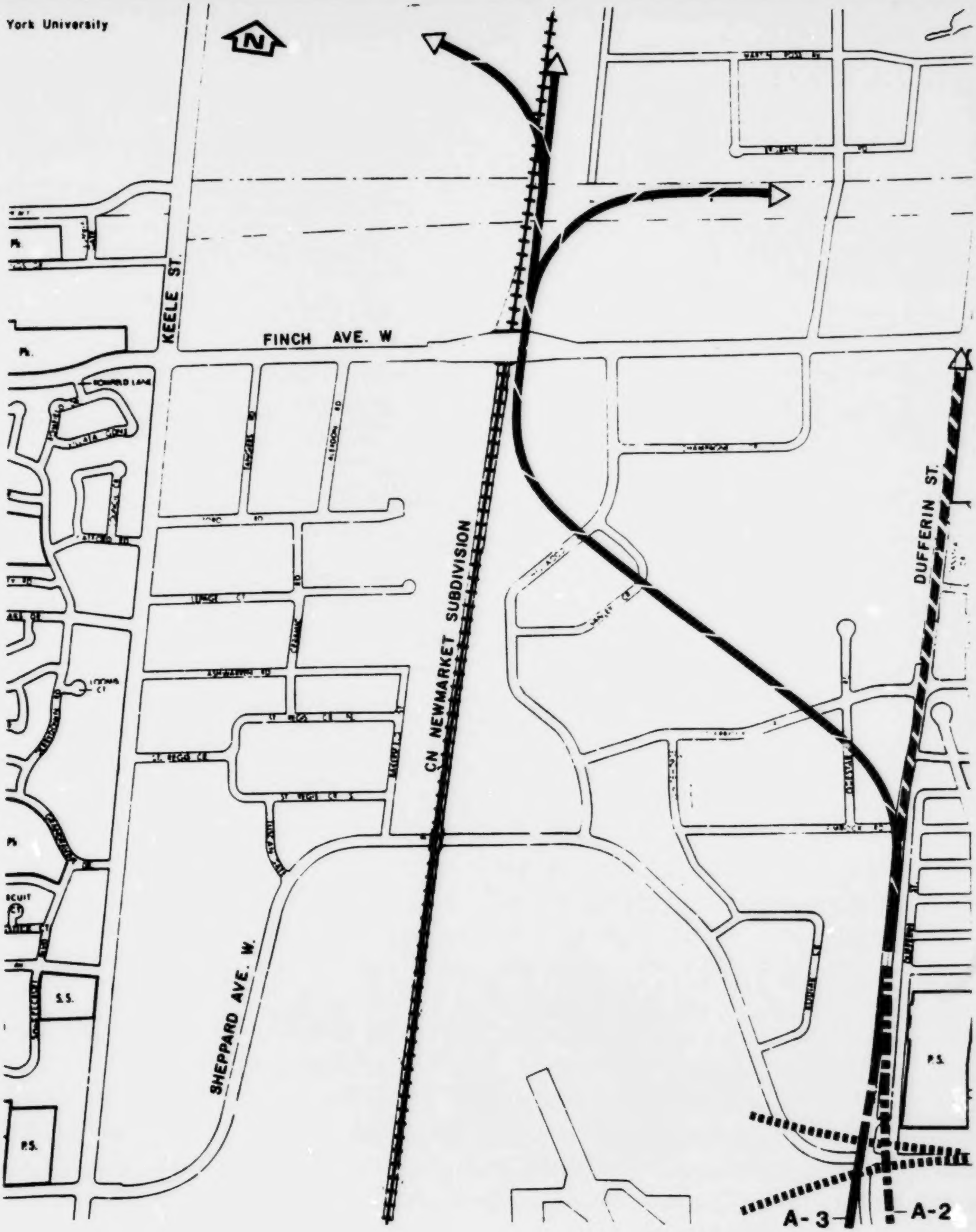
Expansion to the northwest from alternatives A-1 to A-6 and B-2 can be achieved by continuing north under Allen Road for approximately 600 metres before swinging northwest to pass under Metro Works property. From this property an alignment could either curve northwards to parallel the CN Newmarket Subdivision at Finch Avenue or cross the CN line obliquely and continue northwest.

A northwest extension utilizing the Sheppard Avenue road allowance and DND property to reach the CN subdivision is possible if, for alternatives A-1, A-2, A-4 and A-5, the station platforms are moved approximately 200 metres to the south. Alternative A-3 can also be extended along this corridor if the station platforms are aligned along the Sheppard Avenue frontage of the northwest quadrant property. This platform alignment places the station more remote from the potential node of development at the Sheppard Avenue/Allen Road intersection. The use of Sheppard Avenue and DND property appears to offer no major advantages unless a subway extension across the CN subdivision at Sheppard Avenue and north up Keele Street is determined to offer significant benefits as a route to the northwest.

The evaluation of **the ability to expand eastward**, as originally proposed in the Network 2011 Report, highlights the primary difference between the 'A' series and 'B' series alternatives. Both 'B' alignments allow Spadina line trains to operate along an east-west Sheppard line as a continuous service. This enables subway riders to travel from a north-south direction to an east-west direction without changing trains, hence these alternatives are ranked good. Although this capability is convenient from a ride comfort perspective, it does require east-west service to be operated with the same train length and at the same headways as north-south Spadina line service. This may not be the most efficient transportation option.

All 'A' series alignments incorporate a "cross-station" arrangement at the Sheppard/Allen terminal. This configuration, which entails a potential east-west Sheppard line crossing underneath the north-south Spadina line, requires passengers to change trains at the Sheppard/Allen terminal to make a direction change. For this reason all 'A' series alignments are only ranked fair when considering eastward expansion. The recent "Lets' Move" policy statement indicates that eastward expansion along Sheppard Avenue could become a long term option or unnecessary, depending on the outcome of studies of the "loop" proposal.

York University


N
KEELE ST.
FINCH AVE. W
CN NEWMARKET SUBDIVISION
DUFFERIN ST.
SHEPPARD AVE. W.
S.S.
P.S.
P.S.
A-3
A-2

EXPANSION TO THE NORTH ▬ ▬ ▬

EXPANSION TO THE NORTHWEST ▬▬ ▬

EXPANSION TO THE EAST OR WEST ▮▮▮▮▮▮▮▮

OPPORTUNITIES FOR FUTURE EXPANSION

EXHIBIT 7.3.1.

Evaluation of **the ability to expand westward** reveals that all eight alternatives permit subway expansion in a westerly direction by an extension of an east-west Sheppard line passing through the Sheppard/Allen station. Consequently the westward expansion capability of all alternatives is ranked as good.

Assessment of **ability to connect mainlines to a future storage yard** is based on the assumption that a yard may be developed on the Metro-owned land east of Allen Road. Alignments A-1, A-2, A-4, A-5 and B-2 all permit service tracks to be linked to yard tracks without necessitating a crossing of Allen Road. However, as these service tracks would still have to be long to allow acceptable grades from the yard on the surface to underground mainlines, the ranking of these alternatives is limited to "good". Ranking of alignments A-3, A-6 and B-1 is further reduced to "fair" as service connections to these alignments also require a crossing of all or part of Allen Road.

Conclusion: Alignment B-2 is ranked best, with most of the remaining alignments also allowing reasonable flexibility for further extension.

Factor I
Sub-Factor G: Impact on Immediate Study area Road Network

An assessment of the effect of buses, park-n-ride and passenger pick-up/drop-off vehicles on the background traffic leads to this evaluation of the impact of the subway expansion of the study area road network.

In considering impacts on the **existing road network**, it is evident that a northwest quadrant station terminal location will minimize the traffic impact from terminal activities. The more efficient bus accessibility along with reduced impact on the already overloaded Sheppard Avenue/Allen Road intersection are the main advantages contributing to a "low impact" assessment for Alignment A-3.

As discussed earlier, the need to grade separate the Sheppard Avenue/Allen Road intersection along with Alignment A-6 subway construction will result in improved traffic flow conditions; hence A-6 traffic impact is also rated low. All other Alignments which, incorporate the station terminal in the south-east quadrant, result in increased bus and auto traffic movements through the intersection and higher volumes on Sheppard Avenue. Thus the impact is considered moderate, at best.

The impact on the **future road network** has been assessed on the basis of the ability of each alignment to accommodate possible road improvements such as a widening of Sheppard Avenue and grade separation of the Sheppard Avenue/Allen Road intersection. All Alignments and terminal facilities have been configured to permit these improvements with little constraint. Hence, with the exception of A-6, the impact is evaluated as low. Having to implement the road improvements mentioned along with construction of A-6, regardless of need, results in the impact of this Alignment being considered to be high.

Conclusion: **Short and long term impact on the immediate study area road network is assessed to be lowest for Alignment Alternative A-3.**

Factor I
Sub-Factor H: Failure Management Capability

The evaluation of the alignments against this sub-factor showed insufficient significant differences between alternatives to warrant inclusion of this criterion in the comparative analysis.

The assessment of the capability to manage failure situations during operations was based on aspects such as:

- removal of a disabled train from service;
- moving trains in-and-out of service with a primary service connection closed;
- holding a spare train in the event of a dispatching problem;
- an emergency closure of Allen Station;
- emergency access to the right-of-way for fire and ambulance vehicles.

Generally, all alignments permit good response to the first four situations although Alignments A-4 and A-6 have less backup contingency in that a double track service connection at the south end of Wilson yard is not feasible.

Emergency access to the right-of-way will be possible on all alignments. Alternative B-1, with a much longer underground section, is not accessed as conveniently as the others which have more open cut sections where access for emergency vehicles can be arranged. The location of Alignment A-6 in the Allen Road median will necessitate emergency vehicle access from Allen Road which may involve closure of traffic lanes or shoulders.

The probability of emergency vehicle access to a train between stations being necessary is considered low since it is Toronto Transit Commission policy to move subway trains requiring ambulance service to the nearest station as rapidly as possible. A train disabled by a major train fire would be one instance where fire vehicle access may be required.

Conclusion: There are no significant differences among the Alignment alternatives.

7.3.3 Factor II: Social Environment

Nine areas or Sub-factors under Social Environment have been examined, utilizing the set of indicators measures shown on Table 7.1, namely:

A. Construction
B. Vibration (Operation)
C. Noise (Operation)
D. Electromagnetic Interference
E. Air Quality
F. Visual Impact
G. Safety
H. Security
I. Heritage/Archaeology

Of these, **Sub-Factors B,C,D and I were examined with respect to environmental impact and found to be so similar as to provide no basis for distinction** among the alignment alternatives.

Therefore, while impacts are discussed in absolute terms, they have not been included on the summary charts. Because their rankings are identical, they have been screened from the comparative ranking process.

Factor II
Sub-Factor A: Construction

Possible impacts relating to construction of the undertaking include noise, vibration, dust-related air pollution, truck traffic and temporary works.

Noise and vibration-related effects during construction result from the activities associated with construction of the station terminal as well as the infrastructure along the 2km right-of-way. Sources of noise and vibration would include excavation machinery, air compressors, trucks hauling earth and building materials, general building activities and to a lesser extent asphalt paving operations. The evaluation assesses the impact as moderate for alignments A-1, A-2, A-4, A-5 and B-1 since the impact will be confined to the Sheppard/Allen intersection area during station and tail track construction for up to one year, and will only affect homes in the northeast quadrant. Alignments A-3 and B-2 are considered to be removed from sensitive residential areas. The only alignment assessed as having a high impact is A-6 due to the need to construct a major grade separation of Sheppard Ave. and Allen Road along with station and subway construction over a period up to two years.

Examination of **air pollution/dust impacts** associated with each alignment was based on wind patterns[2] in relation to construction of the alignment and terminal facilities and the distance of construction from "sensitive receptors" which, for the most part, are residences. Alternatives whose alignments would run west of Allen Road (A-1, A-2 and A-3, B-1 and B-2) were ranked as having a low dust-related impact arising from construction of the alignment, due to their distance from areas of residential and commercial activity and the intervening Allen Road. Alternatives with terminal facilities sited on the southeast quadrant were given a "high" impact ranking as a result of their location to the south of residences and commercial activities on the north side of Sheppard Avenue and the north

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[2] As measured by highest frequency and highest mean wind speed. Winds during the summer months (assumed to be the most likely for construction purposes) were found to be from the due south and north northwest.

TABLE 7-2
RANKING OF ALTERNATIVES

EVALUATION OF ALTERNATIVES: FACTOR II: SOCIAL ENVIRONMENT									
Sub-Factors	**A-1**	**A-2**	**A-3**	**A-4**	**A-5**	**A-6**	**B-1**	**B-2**	**CONCLUSIONS**
A. Construction	Evaluation of effects of construction on people within the immediate study area.								The location of the best ranked alternative A-3 alignment west of Allen Road and its terminal facilities on the northwest corner (furthest away from residences) should result in lowest construction related effects. It is therefore the preferred alignment. Alternative A-6 would have worst impacts resulting from reconstruction of Allen Road.
a) Noise and vibration	M	M	L	M	M	H	M	L	
b) Air pollution/dust									
Alignment Parking lot	L H	L H	L L	M H	M H	H H	L H	L H	
c) Truck traffic	M	M	M	M	M	M	M	M	
d) Temporary works									
Roads CFB	H, L	M, L	L, L	H, H	M, H	H, H	M, H	L, L	
Sub-Total	2L 2M 2H	2L, 3M, 1H	5L, 1M	M, 2M, 3H	M, 3M 2H	M, 5H	1L, 3H 2M	4L, 1M, 1H	
Sub-Factor Ranking	4	3	1	4	4	7	6	2	
B. Vibration	Evaluation of impact on sensitive receptors of subway-generated vibrations.								Any vibration impacts can be mitigated to fall within MOE guidelines. There is no difference among the alternatives.
C. Noise (operation)	Evaluation of long term noise effect of operation on sensitive receptors.								Any noise impacts can be mitigated to fall within MOE guidelines. There is no difference among the alternatives.
D. Electromagnetic Interference (EMI)	Evaluation of EMI effects of subway operation on sensitive receptors.								There are no EMI impacts associated with any of the alternatives.
E. Air Quality	Evaluation of bus operations on air quality.								The worst air quality occurs at the Sheppard/Allen Intersection. There is no difference among alternative alignments.
F. Visual Impact	Evaluation of visual impact on sensitive receptors.								Alignments running west of Allen Road will have low or no visual effect (A-1 to A-3; B-1 and B-2). Alignment A-3, as the only alternative with terminal facilities on northwest quadrant, would have the least visual impact on residences.
a) Terminal location	L	M	L	M	M	M	M	L	
b) Alignment characteristics	L	L	NI	M	M	M	NI	NI	

TABLE 7-2
RANKING OF ALTERNATIVES

EVALUATION OF ALTERNATIVES: FACTOR II: SOCIAL ENVIRONMENT									
Sub-Factors	**A-1**	**A-2**	**A-3**	**A-4**	**A-5**	**A-6**	**B-1**	**B-2**	**CONCLUSIONS**
Sub-Total	2L	1M, 1L	1L, N	2M	2M	2M	1M, N	1L, N	
Sub-Factor Ranking	2	4	1	5	5	5	3	1	
G. Safety	Evaluation of the potential for accidents during subway and terminal operations.								A-2, A-3, A-5 and B-2 terminal facilities are safest because design minimizes need for pedestrian circulation and because the major separation vertical between north and southbound tracks at the south end of A-4 and A-6 is not required.
Design, planning and operational characteristics of the overall facility	F	G	G	F	G	F	F	G	
Sub-Total	1F	1G	1G	1F	1G	1F	1F	1G	
Sub-Factor Ranking	2	1	1	2	1	2	2	1	
H. Security	Evaluation of potential for interference to persons or property by criminal acts.								Assumes outdoor parking for all alternatives. Security is considered to be good for all alternatives.
I. Heritage/Archaeology	Evaluation of potential for impact on heritage or archaeological features or sites.								No known sites in area. Inspection along the preferred alternative will be completed prior to construction.
Factor Totals									
VG/NI	4VG	6VG	5VG	4VG	5VG	4VG	4VG	5VG	Alternative A-3 is ranked best over all for social environment because it has the least social impact on those living in or passing through the Study Area. Its alignment and terminal facilities are more isolated from residences than all other alternatives.
G/L	4G	4G	7G	2G	2G	1G	4G	4G	
F/M	3F	2F	1F	5F	4F	2F	2F	2F	
P/H	2P	1P		2P	2P	5P	3P	2P	
OVERALL FACTOR RANKING	4	2	1	7	6	8	5	3	

northwest direction of the prevailing winds. Thus, all but A-3, located on the northwest quadrant received the "high" impact ranking.

The **truck traffic** related effect of the alignment alternatives on local traffic would, as Table 7-2 indicates, be "moderate" for Alignments A-1 through A-5. However, Alignment A-6 receives a "high" impact ranking, as do the B series options, as a result of the greater soil removal requirements associated with greater alignment length and distance of tunnelling necessitated.

Impacts associated with **temporary works**[3] vary considerably among the alternatives, with Alignments A-2 and A-3 ranking the best. Both will involve relatively shorter length of roads-related impacts, compared to other options which will experience moderate to high impacts. With respect to duration of projected impacts, Alignments A-2, A-3, A-5 and B-2 are projected to entail lane closures for up to six months, while the remaining alternatives will involve lane closures of as much as one to two years.

As the summary on Table 7-3 indicates, **Alignment A-3 is projected to have the lowest overall construction-related impact**. With the locating of its alignment west of Allen Road and its terminal facilities on the northwest quadrant of the Allen Road/Sheppard Avenue intersection, it is furthest away from homes within the immediate study area. The berm running north from Sheppard Avenue along the east side of Allen Road would also provide a buffer between the proposed terminal and residences. This is in contrast to all other options whose terminal facilities are located in the southeast quadrant, in proximity to homes along Banting and Sheppard Avenues.

Alternative **A-6** at the other extreme would have the greatest construction-related impact, by virtue of the disruption of Allen Road, the location of much of its alignment and its terminal facilities east of Allen Road and its greater length and tunnelling requirements.
Construction of Alignments A-2 and A-4 would require temporary disruption of the berm running north from Sheppard Avenue on the east side of Allen Road; because the berm was originally installed in response to considerable residential complaint regarding noise associated with Allen Road, its disruption would likely be met with concern and upset by these residents, east of Allen Road.

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[3] Temporary works-related analyses examine the length of roads disrupted by construction and the likely duration of such effects on road traffic and on CFB operations.

Conclusion: Overall, Construction-related impacts are lowest for Alignment A-3.

Factor II

Sub-Factor B: Vibration (Operation)

Assessment by acoustical consultants of the impact of vibration associated with operation of the eight alternatives[4] has indicated that with the exception of B-1, all applicable criteria would be satisfied, and that with mitigation, any vibration-related effects associated with B-1 would be eliminated.

The ground-borne vibration criteria presented in Table 7.2.1 were originally developed for use in assessing potential impact of tacitly perceptible ground-borne vibration from rail transit trains at residential and other types of buildings. The criteria were developed because of the finding that use of ground-borne noise limits alone was not sufficient to assure there would be no impact due to tacitly perceptible vibration at lower frequencies.

The criteria stated were first used for environmental assessment and design purposes in the late 1970's and were first published in 1980, reference attached. They have come into use for rapid transit system environmental assessment and design purposes throughout North America during the past decade. The criteria developed are similar to the internationally accepted standards for acceptability of human exposure to vibration in buildings as given in British Standard BS-6472 and International Standard ISO-2631 except that experience has shown these standards to be somewhat too high for quiet residential dwellings such as single-family dwellings.

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[4] Wilson, Ihrig & Associates, Inc. Assessment of Noise and Vibration Impact for the Spadina Subway Extension Project March 9, 1990

The criteria tabulated provide for 5 dB less allowable vibration level for critical residential areas than are indicated for residential buildings in the International and British Standards. Experience with ground-borne vibration from rail transit trains in North America has indicated that this lower level is required in order to avoid significant impact from perceptible vibration in quiet residential environments.

The Department of National Defence has no definite vibration standards for the materials stored at the M.A.D. House and D.N.D. Explosive Storage Building. However, it has been indicated that the materials stored are capable of withstanding the vibration experienced during transport in normal road and rail vehicles. The vibration levels produced in transport vehicles are of much greater amplitude than the ground-borne vibration created by subway trains. Even if the subway structure were to be located within 5 m of the buildings, which could result in vibration velocity at the buildings of up to 0.5 mm/sec, the vibration would be much less than experienced during transport. The normally expected range of vibration of transport vehicles is of the order of 10 to 100 mm/sec or greater.

Thus, the ground-borne vibration from the subway train operations should not present any danger or impact to the materials stored in the D.N.D. Explosive Storage Buildings, which are located approximately 80 metres from the nearest alignment option. DND has also provided written confirmation of their intention to upgrade the storage facility to a "total containment" design within three years.

Conclusion: Because costs associated with mitigation are considered under the Cost factor (V) and because with mitigation all options will have "no impact", **there is virtually no distinction which can be made among the options with respect to vibration-related impacts.**

TABLE 7.2.1

CRITERIA FOR MAXIMUM GROUND-BORNE VIBRATION FROM TRAIN OPERATIONS*

A. Residences and Buildings with Sleeping Areas			
	Maximum Passby Ground-Borne Vibration Velocity Level (dB re 10^{-6} in/sec)		
Community Area Category	Single Family Dwellings	Multi-Family Dwellings	Hotel/Motel Buildings
Average Residential	70	70	75
High Density Residential	70	75	75
Commercial	70	75	75

B. Special Function Buildings	
Type of Building or Room	Maximum Passby Vibration Velocity Level (dB re 10^{-6} in/sec)
Offices	75-80
Commercial & Industrial Buildings	75-85

* Criteria apply to the vertical vibration of the ground surface or of floor surfaces within the buildings.

Factor II

Sub-Factor C: Noise (Operation)

As Table 7-2 depicts, three types of possible noise impacts associated with operation of the undertaking have been examined. These include wayside airborne noise associated with subway operations; ground borne noise associated with subway operations; and noise arising from terminal uses, namely parking and passenger drop off and pick up facilities, the bus concourse and increased bus traffic on Sheppard Avenue. With respect to the first two noise sources, all alignment alternatives are ranked as having "no impact", although some will require mitigation to achieve the "no impact" designation.

With respect to terminal operations, a separate Consultant report[5] has found that all options which place terminal facilities in the southeast quadrant (A-1, A-2, A-4 through A-6 and B-1 and B-2) will result in decibel increases marginally over the ambient levels for homes along Banting Avenue and Sheppard Avenue. The largest change in sound exposure due to the station terminal at any sensitive receptor is 3-4 dBA (i.e., 69 dBA to 72 dBA for properties fronting Sheppard Avenue in the northeast quadrant and 56 to 60 along Banting Avenue). These increases are unlikely to be discernable to most people.

By moving the terminal facilities to the northwest quadrant (A-3) two benefits are realized:

- additional bus traffic on Sheppard Avenue will be reduced; and
- bus concourse activities will be moved to a less sensitive commercial area, and away from a residential area.

The report finds that "commercial uses around the proposed location at the northwest quadrant are not as sensitive to increases in noise levels." [6]

Conclusion: **Alternative A-3 is ranked best as a result of the terminal's location away from sensitive receptors, namely residents along Banting Avenue.**

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[5] Valcoustics Canada Ltd. Technical Report No. 2 - Noise Assessment - Allen Station Proposed Spadina Subway Extension. april 27, 1990

[6] Ibid. p. 7

Factor II
Sub-Factor D: Electromagnetic Interference (EMI)

This Sub-factor was initially considered as a result of some alignments' traversing of Defence Canada lands on which are housed facilities containing explosives which might, potentially, be affected by subway-related electromagnetic interference.

Discussions were held with Defence Canada representatives and analyses were undertaken which found that there would be a concern only if the alignment were to pass within five (5) metres of the DND explosives storage installations. All of the alignments are well beyond this 5 metre range; in fact, the closest distance between any alignment and the DND facilities is 76 metres (Alignment A-3).

Conclusion: **Because this Sub-factor was considered and found to have no environmental impact, it has been excluded from further consideration in the process of determining the preferred alternative.**

Factor II
Sub-Factor E: Air Quality

Evaluation of the alternatives against this sub-factor has addressed the effect of emissions from vehicles, both bus and automobile using the station terminal facilities. An analysis was carried out for this Environmental Assessment by a separate consultant specializing in air quality measurements, analysis and predictions.

The projected traffic data, emission factors and proposed geometrical information were used as input to a numerical dispersion model called CALINE-4 (California Line Source, version 4) [3] to predict peak concentration of nitrogen dioxide (NO_2) and carbon monoxide (CO) for the worst case conditions in the area; i.e., a stable environment, cool temperatures, low wind speed, and light cycle times affecting queuing lengths. The report on the findings of this modelling is included in Appendix 7.3. In summary the conclusions from this analysis were the following:

- Air Quality with the Bus Terminal in Place

The CO concentrations at locations near the intersection were predicted to be very close to the 1-hour MOE criterion. The concentration at one location exceeded the 1-hour 30 ppm criterion with the wind blowing from the west (270 degrees). The main reason for this is the queuing of vehicles at the intersection. With the increase in background traffic volumes, projected for 1994, the queuing length and idling time increases thereby introducing more vehicle exhaust into the ambient air. In the future, CO emissions from vehicles are expected to decrease significantly as set forth by government guidelines. Thus, since traffic cannot increase beyond the capacity of the road system then the future concentrations of CO will likely be lower than those predicted. At locations away from the intersections, the concentrations were predicted to satisfy the MOE 1-hour CO criterion, but the concentrations remained relatively high. The frequency of exceeding the 1-hour CO criterion (30 ppm) was not assessed in this study.

The concentrations of NO_2 were predicted for both limits of the reasonable range of conversion of nitrogen oxide to nitrogen dioxide, (i.e. 10% and 25%). These rates are strongly dependent on available sunlight and local ozone concentration. At a 25% conversion, the NO_2 concentrations were predicted to equal or exceed the 1-hour criterion of 0.2 ppm at several locations. At 10% conversion, one exceedance was found at one receptor. Also, concentrations at several other receptor locations were found to approach the 1-hour NO_2 criteria. Again, these locations were near the intersections. At peak traffic times under worst case conditions, the air quality is thus expected to be poor to moderate.

Another important point is that the traffic counts for 1986 seem to indicate that traffic volumes during off-peak hours does not decrease significantly. If the recommended method for calculating concentrations at different averaging times is used [4], then exceedances of the more stringent 8-hour CO criterion are likely.

Emissions from vehicles at the intersections are the major contributors to the air quality impacts in the area. Therefore the choice of quadrant for the station and bus terminal is not expected to significantly affect the surrounding air quality.

- Predicted Air Quality without the Bus Terminal

The numerical model was also run with future traffic but without the bus terminal i.e., no subway station. The changes in predicted concentrations from the case with the bus terminal in place were very small. The largest difference (1.8 ppm CO) occurred at a receptor just off Banting Ave. As expected, the emissions from vehicles at the intersections are the major contributors to the air quality impacts in the area near the intersections.

Since the change in predicted concentrations for the two analyses were very small, it may be concluded that the air quality impacts due to the presence of the proposed bus terminal and subway station will be minimal. Thus, although the air quality was predicted to be approaching (and exceeding in some cases) the MOE criteria in this worst case scenario, the air quality impact due to the presence of the bus terminal and car park at the proposed Sheppard-Allen site is expected to be low.

Conclusion: **Air quality at the intersection of Sheppard Ave. and Allen Road was predicted to approach (and exceed in some cases) the MOE criteria for (CO) and nitrogen dioxide (NO_2) regardless of the presence (or quadrant location) of the subway station surface facilities. Numerical modelling predictions of the air quality impact due to the presence of the station show the impact to be low for all alternatives.**

Factor II
Sub-Factor F: Visual Impact

The extent to which both the terminal facilities and alignments can be seen by residents and other land uses has been examined.

As Table 7-2 indicates, the **terminal facilities** of all alternatives except A-1 and A-3 are located in the southeast quadrant and would be seen by residents along Banting Avenue and the north side of Sheppard Avenue. While some residents along Banting Avenue would view the facility from their front yards, others would see it from their side yards. As noted previously, the terminal facilities are comprised of the Park-n-Ride, passenger drop off and pick up, and bus terminal components, as well as the below grade subway station. It is the first three components which would be visible. Visual impact is softened somewhat by the presence of adjacent commercial/institutional buildings along Sheppard Avenue and by the Allen Road corridor. Terminal facilities of Alternative A-3 would have no visual impact on residences by virtue of the northwest quadrant location and the berm running north from Sheppard Avenue along the east side of Allen Road. Commercial/industrial properties to the north and west of the northwest quadrant would have a view of the facility.

"Low" rankings have been given to A-1, A-3 and B-2.

With respect to the **alignments** themselves, those which run west of Allen Road (A-1, A-2, A-3, B-1 and B-2) should have little or no visual impact, as a result of the intervening Allen Road corridor between it and residents. In addition, these options' alignments are below surface (in an open cut or underground).

Alignments A-4, A-5 and A-6 should have greater, but still somewhat limited visual impact, though their alignments run much closer to the residential areas which are located along Banting Avenue and Reimer Road. Because options A-4 and A-5 run closely to Allen Road along its east side and because they are entirely below grade, only a chain fence should be visible to residents along the above-mentioned streets. Currently, there is already such a fence along the edge of Allen Road, so that there should be limited difference in visual impact from existing conditions. Because the alignment of A-6 runs along the Allen Road median and is within an existing transportation corridor, there should, again, be limited visual impact.

Conclusion: **Alignment A-3, as the only alternative with terminal facilities on the northwest quadrant, would have the least visual impact on residents.**

Factor II
Sub-Factor G: Safety

In evaluating the safety[7] of the alignment alternatives, an assessment of the design, planning and operational characteristics of the overall facility has been undertaken in consultation with TTC senior safety specialists.

Options A-2, A-3, A-5 and B-2 have been ranked as "good" relative to other options by virtue of a terminal design which minimizes circulation elements.

The remaining options have been ranked as "fair" with respect to safety, for a variety of reasons, noted on Table 7-2. These include more complex circulation elements and greater vertical difference between north and southbound tracks.

Conclusion: A-2, A-3, A-5 and B-2 are the preferred options from a safety perspective.

Factor II
Sub-Factor H: Security

In evaluating the security[8] of the alignment alternatives, an assessment of the design, planning and operational characteristics of the overall facility has been undertaken in consultation with TTC senior security specialists.

Conclusion: Security is considered to be "good" for all alternatives.

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[7] The evaluation of safety focuses on the potential for accidents during subway and terminal operations.

[8] Evaluation of security focuses on the potential for interference to persons or property by criminal acts.

Factor II

Sub-Factor I: Heritage/Archaeology

There are no known archaeological sites within the area covered by the alternative alignments or within the immediate Study Area.

In any event, the TTC will contact the Ontario Ministry of Culture and Communications at the time the centre line is surveyed for the preferred route. Surface inspection will occur prior to topsoil stripping and a license report will be filed with the Ministry.

If any artifacts are discovered during construction, the TTC will stop construction work immediately and inform the Ministry of the find in order to take appropriate protective measures.

Conclusion: **There are no known sites in the area. Inspection along the preferred alternative will be completed prior to construction.**

Summary

Criteria which could potentially affect the social environment have been assessed with respect to the alignment alternatives. As Table 7-2 depicts, **Alignment A-3 would have the least impact on the social environment**, largely as a result of the siting of terminal facilities on the northwest quadrant, away from residential areas. Of the remaining alternatives, **A-2 as Table 7-2 indicates, is the second most preferred**, based on its rankings in each of sub-factors. Alignments A-6, B-1 and B-2 appear to be the least preferred from the perspective of the social environment.

7.3.4 Factor III: Bio-physical Environment

In the course of developing evaluation criteria, many types of potential bio-physical impacts were considered. These included vegetation, wildlife, soil erosion, presence of contaminated soil, and surface water runoff/drainage. The analysis of existing conditions had, however, demonstrated that biophysical features were limited in relation to the alignment alternatives. Because they all lie largely within an existing transportation corridor and within an urban environment, there are no vegetation or wildlife elements which will be affected by the proposed undertaking.

The three Sub-factors identified as deserving consideration are soil contamination, soil erosion and runoff/drainage. More detailed examination has shown that **there are no bio-physical impacts which differentiate one alignment alternative from another or which are cause for concern.**

Factor III
Sub-Factor A: Contaminated Soils

Contaminated soils have been identified in the Metro Works Yard, consisting of levels of lead, oil and grease which exceed agriculture/residential/parkland criteria. The yard is zoned residential (R4) by the City of North York. If the land use of the Yard were changed to residential or parkland, then the site would have to be remedied, most likely by soil removal and off-site disposal. Under current conditions however, storage on-site meets the Ontario Ministry of the Environment's decommissioning guidelines for industrial/commercial lands. All alignment alternatives are affected and would require on-site soil storage.

Conclusion: **Contaminated soils do not affect selection of the preferred alignment.**

Factor III
Sub-Factor B: Soil Erosion

There is potential for erosion of exposed soil materials during construction. The flat topography should aid the effectiveness of sediment control and restoration of exposed sites with a vegetative cover mix of grasses and forbs. This will be particularly important in soil storage areas.

Conclusion: **Soil erosion does not affect selection of the preferred alignment.**

TABLE 7-2
RANKING OF ALTERNATIVES

EVALUATION OF ALTERNATIVES: FACTOR III: BIOPHYSICAL ENVIRONMENT

Sub-Factors	A-1	A-2	A-3	A-4	A-5	A-6	B-1	B-2	CONCLUSIONS
A. Contaminated Soils	Discussed in text.								Minor concern on Metro Works Yard only. Mitigation can be incorporated.
B. Soil Erosion	Discussed in text.								Short and long term mitigation measures can be incorporated in all alternatives.
C. Runoff/Drainage	Discussed in text.								Mitigation measures can be incorporated in the design of all alternatives.

EVALUATION OF ALTERNATIVES: FACTOR IV: LAND USE

Sub-Factors	A-1	A-2	A-3	A-4	A-5	A-6	B-1	B-2	CONCLUSIONS
A. Consistency with Planning Policies									All alternatives are consistent with planning policies. All three agencies recognize the need for improved rapid transit and have identified subway expansion priorities, all of which require completion of this proposed undertaking.
Ministry of Transportation of Ontario	Discussed in text.								
Municipality of Metropolitan Toronto									
City of North York									
B. Immediate Impact on Adjacent Properties									No immediate impacts on adjacent properties have been identified. All alignments are compatible with adjacent land uses with respect to subway infrastructures. All alignments are within existing transportation corridors and none adversely affects employment, housing or access to adjacent properties.
Compatibility of subway infrastructure with adjacent land uses	Discussed in text.								
Present access to adjacent properties									
Acquisition of lands required									
C. Impact on Future Land Uses									All alternatives present minimal impact on future land use. Potential future integration of subway station sites into some form of commercial/residential complex could be accommodated at either a northwest or southeast location, given the requirement for appropriate zoning and land acquisition at prevailing costs.
a) Adaptability to future potential use of CFB lands for residential/commercial/other uses	Discussed in text.								
b) Future use of Metro lands	Discussed in text.								
c) Northeast quadrant of Sheppard Avenue/Allen Road intersection	Discussed in text.								
d) Northwest quadrant of Sheppard Avenue/Allen Road intersection	Discussed in text.								

Factor III

Sub-Factor C: Runoff/Drainage

With the exception of Alignment A-4, all alternatives will require trench dewatering and on-site sediment holding ponds during construction to mitigate against flooding, which is likely to arise on Defence Canada property because of its flat topography and impermeable clay till soils.

For all alignments during construction, there is the potential for some discharge of sediment, to the storm sewer from the bus concourse and parking facilities, and hence the need for local sedimentation control.

Conclusion: Surface water runoff and drainage should be controlled on-site and will have no affect on selection of the preferred alternative.

7.3.5 Factor IV: Land Use

Land use-related impacts potentially arising from the undertaking have received careful examination. Three Sub-factors were developed to encompass potential concerns, namely:

A: Consistency with Planning Policies
B: Immediate Impact on Adjacent Properties
C: Impact on Future Land Uses

The results of these analyses indicate that it is only with the third Sub-factor that distinctions emerge among the alignment alternatives. Thus, while C is contained on Table 7-2, A and B are not, and are addressed below:

Factor IV

Sub-Factor A: Consistency with Planning Policies

As discussed in Section 3 which describes existing planning policies, The Ministry of Transportation of Ontario, Metropolitan Toronto and the City of North York have all recognized the need for improved rapid transit in their policies. Also, they have identified subway expansion priorities which all require completion of this proposed undertaking.

Each of the alignment alternatives has been designed to facilitate future expansion in northerly, northwesterly, west or eastbound directions, to allow maximum flexibility in responding to future policy decisions regarding the direction of subway expansion beyond the proposed Undertaking.

Conclusion: **None of the alignment alternatives can be distinguished as being more preferred than another from a planning policy perspective.**

Factor IV

Sub-Factor B: Immediate Impact on Adjacent Properties

From a strict land use perspective[9], none of the options involves a loss of employment or housing and none adversely affects access to adjacent properties. If anything, properties which are adjacent to terminal facilities are likely to increase in value by virtue of proximity to a subway station.

The alignments themselves are within an existing transportation corridor and have no adverse impacts on adjacent land uses.

Conclusion: **No immediate impacts on adjacent properties have been identified.**

Factor IV

Sub-Factor C: Impact on Future Land Uses

As Table 7-2 indicates, future land use impacts have been examined and found to differ among alignment alternatives, with respect to the future potential use of Department of National Defence (DNO) lands for residential/commercial/other uses and of Metro lands. In addition, discussion of possible future land use directions for the northwest quadrant are important to consideration of this Sub-factor.

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[9] Impacts such as noise, vibration and transportation-related effects of the alignment alternatives on adjacent properties have been addressed in Factors other than land use and are not addressed in this Factor.

A number of Alignment alternatives traverse the DND lands either underground and/or in an open cut. The possibility that these lands might, in the future, be no longer needed by the Department, and redeveloped for residential uses has been considered. Each Alignment has been examined for its flexibility to incorporate a future terminal to serve future residents of such a development. In this regard, all but Alignments A-4, A-5 and A-6 have been ranked as providing "good" adaptability for future use. A-4 and A-5's alignment and terminal locations east of Allen Road and A-6's alignment along the median of Allen Road inhibit access from the lands west of Allen Road. The remaining options would provide good flexibility.[10]

In assessing the difference in future development capability assuming a northwest quadrant location for the terminal (Alignment A-3) and a southeast quadrant location (all other alignments), two scenarios have been examined:

- integration of TTC facilities with other types of development (eg. commercial/residential);
- no integration of TTC facilities with other types of development.

Scenario 1: Integration

The Northwest Quadrant

With respect to the first scenario, the North York Official Plan designation for the northwest quadrant of the Sheppard Avenue/Allen Road intersection is Commercial, and its zoning, Industrial Commercial. The owner of the property has received site plan approval for a development consistent with these zoning requirements.

The implications of integrating terminal facilities in this quadrant have been explored with the owner, who has expressed interest in pursuing such a plan. On a preliminary basis, it has been determined that the facilities required for a TTC terminal can physically be accommodated and integrated with the commercial development already approved for the site. Depending on the exact nature of a finalized, (as compared to very preliminary) plan, however, new site plan approval would, at the very least, be required and it is also possible that minor variance(s) and/or re-zoning would be needed.

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[10] Subject to cost considerations, there may be merit in placing open cut portions of these alignments running west of Allen Road entirely underground to allow for maximum future use of the DND lands. The question around the future disposition and availability of DND lands for development raises the question as to whether the costs of placing the open cut portions underground should be undertaken now, or whether such costs should be borne at some time in the future when and if development becomes possible.

Because consideration of integration on the northwest quadrant can only be undertaken in a preliminary way at this time, and because planning approval would be dependent on finalized plans, the merit of integration can only be termed as attractive on a preliminary basis. Similarly, there are other cost considerations which would have to be resolved between the owner and the TTC.

Thus, there is uncertainty regarding whether or not an arrangement for integration on the northwest quadrant which is satisfactory to both parties can, in fact, be finalized. In essence, there are non-environmental questions which cannot be answered at this time which make it difficult to characterize the option beyond "favourable on a preliminary basis".

The Southeast Quadrant

Integration of TTC terminal facilities with other types of development on the southeast quadrant would require an Official Plan amendment, rezoning and site plan approval. In addition, rezoning could be delayed, as current issues related to provision of sewage capacity would have to be resolved. (See Section 3.5.2 for a discussion of sewage capacity.) The size of the property provides considerable flexibility for any design-related concerns to be satisfied. While, as just noted, such integration would be dependent on planning approvals, uncertainties associated with negotiating with a private owner (as is the case with the northwest quadrant) would not be present.

Scenario 2: No Integration

Assuming no integration of transit facilities with other types of development, a southeast quadrant location for the terminal would, from a planning approvals perspective, be relatively straightforward. The property is zoned Industrial and it has been understood that the property would be used for transportation purposes by Metropolitan Toronto.

A northwest quadrant location for a terminal, assuming no integration, would require acquisition of the site.

Conclusion: **All Alignment alternatives are, from a land use perspective, consistent with policies of the relevant jurisdictions. Each of the options (northwest and southeast quadrant stations) is acceptable from a North York perspective. Future land use policies will address the existence of the subway and possible future station locations.**

7.3.6 Factor V: Cost

Factor V

Sub-Factor A: Property Acquisition Costs

Property acquisition costs for each alignment and station terminal have been derived using unit cost estimates of market value developed by Metro Toronto Parks and Property Department staff for all property required regardless of present ownership. These estimates, based on the location of the parcels needed within the corridor, have been applied to the area of each type of parcel to obtain the overall cost for each alignment. Where negotiation of an underground easement is considered feasible, this assumption has been made and appropriate lower unit have been applied to the easement area.

The cost estimate comparison reveals that alignment A-6 has the lowest property acquisition cost because the subway right-of-way is integrated into a widened Allen Road right-of-way. Alignment B-1 is next lowest because most of the route occupies an underground easement. Terminal facility costs are common for most alternatives, B-2 being the only exception since longer access roads are required for this option.

Acquisition costs for alignments A-2, A-4 and A-5, are similar and fall into the mid-range. Alignment A-3 property costs is somewhat higher because of the need to impact a larger portion of Department of National Defence Property. This cost could be reduced either by negotiation of underground easement or by resale of some parcels acquired between the subway and Allen Road.

Factor V
Sub-Factor B: Construction Costs

This sub-factor reflects the comparison of the estimated total cost of all capital works necessary to implement the subway extension. The costs are quoted in 1989 and are based on unit rates developed in consultation with Toronto Transit Commission estimating staff. The estimates include allowances for engineering and administrations well as change orders during implementation and contingency items. Procurement costs for additional subway vehicles to operate the extension are not included in the figures presented.

Alignment A-5 is ranked highest as it emerges as the lowest cost alternative mainly due to the alignment design only meeting minimum standards. Alignments A-2 and A-3 are ranked next highest with capital costs in the $120-125 million range. This higher cost achieves the other transportation and environmental benefits not present in alignment A-5. While the alignment A-2 cost appears to be slightly lower it should be noted that the A-3 alternative extends further north of Sheppard Ave. because of the station location in the northwest quadrant. Conversely, the alignment A-2 estimate includes the cost of a crossing of Allen Road, an element which may still be required for alignment A-3 if an extension further north on the east side of Allen road is considered desirable in the future.

Factor V
Sub-Factor C: Operation and Maintenance Costs

The evaluation of costs associated with operating the service and maintaining the infrastructure is based on an assessment of any significant cost differences between alignment alternatives with regard to subway operations, feeder bus operations and track and facilities maintenance.

In considering subway operations, cost differences could arise from:

- increased length of alignment and consequently trip time;
- complexity of service connections requiring more time and labour to bring trains into-and-out-of-service;

TABLE 7-2
RANKING OF ALTERNATIVES

EVALUATION OF ALTERNATIVES: FACTOR V: COST									
Sub-Factors	**A-1**	**A-2**	**A-3**	**A-4**	**A-5**	**A-6**	**B-1**	**B-2**	**CONCLUSIONS**
A. Property Acquisition	Evaluation of the costs associated with property acquisitions required for the alignment and terminal.								Alignment A-6 has the lowest property acquisition cost because the subway right-of-way is integrated into a widened Allen Road right-of-way. B-1 is next lowest because most of the route occupies an underground easement. Terminal facility property costs are common for most alternatives. The total property cost for A-2, A-4 and A-5 falls into the mid-range.
Total acquisition cost in millions	$50	$44	$50	$45	$40	$28	$30	$47	
	P	F	P	F	F	VG	VG	P	
Sub-Factor Ranking	4	2	4	3	2	1	1	3	
B. Construction	Evaluation of the costs of construction associated with the alignment.								Alignment A-5 ranks best on construction cost being the cheapest to build since it only meets minimum standards. Alignments A-2 and A-3 rank second best, reflecting a moderate cost increase in construction cost in order to achieve other benefits.
Cost total in millions of all capital works necessary to implement subway	$135 -140	$120-125	$120 -125	$155 -160	$110 -115	$150 -155	$160 -165	$135-140	
	F	G	G	P	VG	P	P	F	
Sub-Factor Ranking	3	2	2	4	1	4	4	3	
C. Operation and Maintenance	Evaluation of the costs associated with operating the service and maintaining the infrastructure.								Alignment A-3 ranks the best for this sub-factor, reflecting best overall performance in cost of operation of the subway; track and facility maintenance; and lowest feeder bus operation costs resulting in possible fleet savings. Alternatives A-1 and A-2 rank in second place due to higher feeder bus operating costs.
	G	G	VG	F	F	F	F	F	
Sub-Factor Ranking	2	2	1	3	3	3	3	3	
D. Future Expansion	Evaluation of the construction costs which would be associated with future expansion options.								Alignments A-2, A-4 and A-5 rank best overall for this sub-factor, with A-3 in second place. This generally reflects lower costs related to ease of development of the subway system to the north, east and west. Expansion to the northwest is a costly option for all alternatives.
a) Expansion in a northward direction	G	G	G	G	G	F	P	G	
b) Expansion in a northwest direction	F	F	F	F	F	F	P	F	
c) Expansion in a easterly direction	F	G	G	G	G	G	F	F	
d) Expansion in a westerly direction	F	G	G	G	G	G	F	F	
Sub-Factor Ranking	4	1	2	1	1	3	5	4	
Factor Totals									Alignment A-5 ranks marginally higher from the overall cost factor, with A-2 following a close second. The difference occurring in construction cost will be offset in the long term by higher operating and maintenance costs for A-5. Costs for alignment A-3 are also favourable, but include more investment in property. This could however be recovered by re-sale of severed portions.
VG/NI			1VG		1VG	1VG	1VG		
G/L	2G	5G	4G	3G	4G	2G		1G	
F/M	4F	2F	1F	3F	2F	3F	3F	6F	
P/H	1P		1P	1P		1P	3P		
OVERALL FACTOR RANKING	6	2	3	5	1	4	8	7	

- time consuming turn-back operations at the terminal; and

- alignment geometry which reduces train performance and increases energy consumption.

Assessment of the eight alternatives highlights only two which are significantly longer, i.e. A-3 and B-1 however the additional length of A-3 becomes irrelevant when further network expansion is pursued Alignments A-4 and A-6 require more complex service connections which will increase subway operating costs. The low standard geometry of Alignment A-5 will add to regular operating costs.

The cost of feeder bus operations is mainly dependent on the accessibility of terminal facilities. In this aspect, Alignment A-3 has a clear advantage in that the northwest quadrant location will provide quicker, easier access for the majority of buses serving the new subway station i.e. those approaching from the west and north. This advantage could translate into lower bus fleet acquisition costs which would add to the anticipated operating cost savings.

Track and facility maintenance costs will vary with the quality of the alignment, the complexity of the facilities and the length of right-of-way to maintain. Alignments A-1, A-2 & A-3 will not result in any abnormally high maintenance costs, a factor contributing to their overall "good" or very "very good" ranking. Alignment A-5 with excessive curvature will incur higher track maintenance costs as will the greater length of alignments B-1 and A-4.

Factor V
Sub-Factor D: Future Expansion Cost

The rankings assessed for expansion in each direction reflect a qualitative evaluation of the construction costs anticipated for future expansion options.

Considering **expansion in a northward direction,** alignments A-1 to A-5, and B-2 are not expected to incur any abnormal construction costs as a convenient right-of-way exists, hence all are ranked "good." Expansion of alignments A-6 and B-1 northward will require higher than usual costs resulting from integration with Allen Road reconstruction or the circuitous route necessary for B-1.

Expanding the system to the northwest requires an underground alignment at least up to Finch Avenue. Most of this alignment would likely require tunnelling as surface development precludes cut-and-cover construction. Since a continuous corridor, able to accommodate subway expansion, is not available the cost of northwesterly expansion is assessed as "fair" for most alignments. The exception is B-1 which is ranked "poor" because it is primarily aligned to continue eastward with northwesterly expansion assumed to be offered by an east-west Sheppard subway line.

Eastward Expansion is possible at moderate cost for most alignments as the Spadina station is at minimum depth hence construction of a Sheppard line underneath and continuing under the Sheppard Avenue road allowance will not incur any abnormal costs. Exceptions are alignments A-1, B-1 and B-2 where excessive depth in the case of A-1 and stacked Spadina and Sheppard line sections for B-1 and B-2 will add cost penalties to eastward expansion.

For most alignments, **a westward expansion** is also possible at moderate cost except for alignments A-1, where the subway would have to be deeper and B-1 and B-2 which again require costly stacked sections where Spadina and Sheppard lines overlap. Also the minimum radius curves needed will add to long-term maintenance costs.

Summarizing, alignments A-2, A-4 and A-5 rank best overall considering future expansion costs with A-3 in second place.

7.4 Findings of the Evaluation

As recommended in the Ontario Ministry of the Environment Interim Guidelines on Environmental Assessment Planning and Approvals, "the likely environmental effects of each alternative on the full definition of environment" have been identified and described. A discussion of the methods that were used to predict environmental effects has also been provided.[11]

In the next Sub-Section of this Report the evaluation of the eight alignments is utilized as a basis for determining the preferred alternative(s).

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[11] Guidelines. pp.33 and 34.

Table 7-3 provides a summary of the findings of the preceding evaluation. It reveals that when all five factors are taken into consideration:

- Alignment Alternatives A-2 and A-3 are ranked in first place from an overall transportation perspective.
- Alignment Alternative A-3 is ranked in first place for overall social environmental impact, with A-2 being ranked second.
- Alignment Alternative A-5 is ranked marginally higher than alternatives A-2 and A-3 from overall cost considerations, but is not rated highly in most other factors. Alignment A-2 is ranked second with A-3 ranked third for the cost factor.

From this comparative analysis, **Alignments A-2 and A-3 have clearly emerged as the alternatives which minimize environmental impact and respond best to performance requirements on an overall basis**. The least preferred alternatives are the B Alignments and Alignment A-1.

In order to determine which, if either of Alignments A-2 and A-3 are preferred, the key elements and tradeoffs related to these two alternatives have been reviewed in detail and subjected to a sensitivity analysis.

7.4.1 Transportation

Considering this Factor as a whole, Alignments A-2 and A-3 are equivalent for all indicator rankings (See Table 7-4). However, a comparison of ranking order of each alignment within the subfactors shows Alignment A-2 with 3 first and 4 second place rankings. (Again, see Table 7-4). This compares to Alignment A-3 with 4 firsts, 1 second and 2 third place rankings. Alignment A-2 appears to be marginally favoured over A-3, from this unweighed analysis. This is arrived at solely on the basis of relative comparisons of numerical rank.

However, there is an additional element to be considered. The relative importance to the proponent and the public, of each subfactor, must be further evaluated to determine which alternative responds best to transportation needs. Closer scrutiny reveals that key differences between Alignment A-2 and A-3 occur in the following five areas within the Transportation Factor:

Alignment A-2:

- has a marginally better mainline track alignment.
- permits marginally better internal terminal circulation.
- provides slightly better connections to a future yard east of Allen Road.

Alignment A-3

- results in better external accessibility for feeder buses.
- has a lower impact on the existing and future road network.

In addition A-2 and A-3 are as convenient to connect to Wilson Yard; offer equal terminal operational efficiency; and are compatible with future subway extension to the north, east and west.

A comparison of the above differences leads to the conclusion that the benefits to the Public and the Proponent obtained from the areas where A-3 is better, outweigh the benefit in the areas where A-2 ranks higher. However the overall advantages of A-3 can only be realized if satisfactory integration of internal transit terminal facilities into the private development, can be achieved.

7.4.2 Social Environment

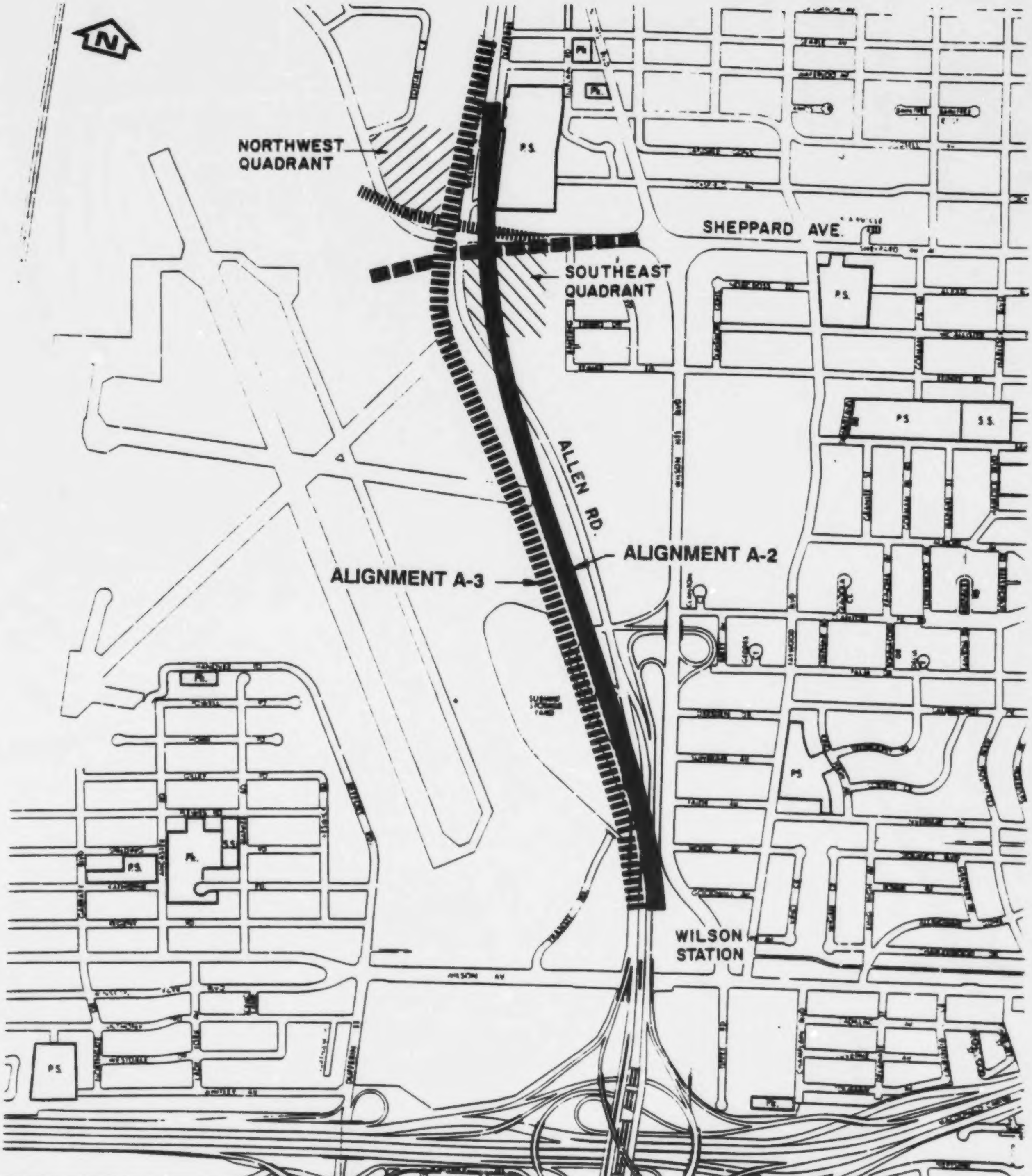
The impact on the social environment is lower for Alignment A-3 when compared overall, with that for Alignment A-2. Alignment A-3 has more good rankings and no poor rankings for the overall factor, in contrast to A-2 (see Table 7-4). Alignment A-3 has 3 first place rankings overall for the three sub-factors considered. Alignment A-2 has 1 first, 1 second and 1 fourth place ranking.

TABLE 7-3
SUMMARY OF PERFORMANCE AND IMPACT RANKINGS
RELATIVE UNWEIGHTED COMPARISON FOR ALL FACTORS AND ALTERNATIVES

EVALUATION OF ALTERNATIVE ALIGNMENTS									
Alignment	A-1	A-2	A-3	A-4	A-5	A-6	B-1	B-2	
FACTOR 1 TRANSPORTATION	7	1	2	5	3	8	4	6	A-2 is preferred in the transportation factor, with A-3 in second place.
FACTOR II SOCIAL	5	2	1	7	6	8	4	3	A-3 is preferred in the social factor with A-2 in second place.
FACTOR III BIOPHYSICAL									No significant impacts.
FACTOR IV LAND USE									No significant impacts.
FACTOR V COST	6	2	3	5	1	4	8	7	A-2 is in second place for overall cost and A-3 in third place. A-5 has lowest cost but falls down in the other major factors.
SCORE - PREFERRED ORDER A-2 - 1 1ST, 2 2NDS A-3 - 1 1ST, 1 2ND, 1 3RD A-5 - 1 1ST, 1 3RD, 1 6TH PREFERRED OPTION A-2 (UNWEIGHTED)									Overall factor evaluation shows A-2 to be the preferred route with 1 first and 2 seconds. A-3 is in second place with a first, a second and a third.

TABLE 7.4
SUMMARY OF SENSITIVITY ANALYSIS FOR TWO PREFERRED ROUTES

	ALTERNATIVE A-2	ALTERNATIVE A-3
Transportation (7 sub-factors)	3 1sts: Sub-Factors A,B,C 4 2nds: Sub-Factors D, E,F,G	4 1sts: Sub-factors B,C,D,G 1 2nd : Sub-factor A 2 3rds: Sub-factors E,F
Rankings	4 VG/NI 13 G/L 7 F/M	4 VG/NI 13 G/L 7 F/M
Social (3 sub-factors)	1 1st: Sub-factor G 1 3rd: Sub-factor A 1 4th: Sub-factor F	3 1sts: Sub-factors, A,F,G
Rankings	6 VG/NI 4 G/L 2 F/M 1 P/H	5 VG/NI 7 G/L 1 F/M
Cost (4 sub-factors)	1 1st: Sub-factor D 3 2nds: Sub-factor A,B,C	1 1st : Sub-factor C 2 2nds: Sub-factor B,D, 1 4th : Sub-factor A
Rankings	5 G/L 2 F/M	1 VG/NI 4 G/L 2 P/H


N
NORTHWEST QUADRANT
SOUTHEAST QUADRANT
SHEPPARD AVE.
P.S.
S.S.
ALLEN RD.
ALIGNMENT A-2
ALIGNMENT A-3
WILSON STATION
WILSON AV

THE HIGHEST RANKED ALTERNATIVES

EXHIBIT 7.4.1.

The reduced impact stems mainly from the fact that A-3 is further removed from residential neighbourhoods. Construction is totally west of Allen Road for Alignment A-3, making dust, noise, vibration and other construction-related disruptions somewhat less than A-2, which runs east of Allen Road, closer to residential areas.

Further, the A-3 northwest quadrant station location is in a commercial/industrial area where noise, visual and air quality impacts are isolated from residential neighbourhoods.

Alignment A-2 however, remains an environmentally acceptable option.

7.4.3 Bio-physical Environment

Bio-physical criteria requiring evaluation have included disturbance and disposal of contaminated soils, the potential for soil erosion and the impact of subway infrastructure on run-off and drainage patterns in the study area. Generally, no major differences in impact were identified between alignments and in all cases, the impact was determined to be low or non-existent.

7.4.4 Land Use

Evaluation of land use impacts was based on the Alignments' consistency with planning policies, their impact on the existing land use of adjacent properties and finally, their compatibility with potential future land uses in the Study Area.

It was found that both Alignments A-2 and A-3 are consistent with the planning policies of the main jurisdictions namely the Province of Ontario, Metropolitan Toronto and the City of North York. Both alignments are also compatible with the "Let's Move" initiative of the Province of Ontario. It was also established that both Alignments could be integrated in a manner compatible with existing land use without adverse effects on present access to adjacent properties.

In both cases, the acquisition of land for right-of-way along the eastern boundary of the CFB Toronto has been favourably received by the Department of National Defence. This would sever parcels between the subway and Allen Road which could be used for future development in the event of a change of land use of the DND property. Also a future station on redeveloped DND land could be accommodated with both alignments.

The implications of integrating proposed TTC terminal facilities with other types of development on the northwest quadrant (Alignment A-3) and southeast quadrant (Alignment A-2) have been examined. The current North York Official Plan designation, zoning and availability of sewage capacity on the northwest site provide a preliminary basis for viewing integration in a favourable light. However, pursuing the northwest option requires favourable financial arrangements with the present owner. Integration on the southeast quadrant would be subject to an Official Plan amendment and rezoning plus associated municipal servicing.

It can be concluded that Land Use impacts are generally similar for both alternatives. Present ownership of the proposed station terminal site is the only key difference between these options.

7.4.5 Cost of the Undertaking

The merits of each alternative have been compared by assessing property acquisition costs, estimated construction costs, factors which would increase normal operating costs, and the potential impact on the cost of future extensions.

Alignment A-2 is preferred over A-3 for property acquisition cost, but both are within the same range of construction costs. Alignments A-2 and A-3 carry total capital costs in the $160-180 million range, with A-2 being in the lower end of the range. The cost differences would be greater if the assumption that property acquisition costs for the station are equal, was not made. This assumption was necessary because there is no way of knowing what actual negotiated costs would be.

This approach does not reflect any advantage of the A-2 station, being on Metro-owned land, potentially being acquired at a much lower cost. It also does not reflect potentially favourable opportunities related to private sector investment for the A-3 station.

Alignment A-2 is better than A-3 for the impact on future subway extension cost. However, ongoing operating and maintenance costs for Alignment A-3 would be lower than A-2, due to the more efficient feeder bus access to the station site.

7.4.6 Summary

In summary, both Alignments A-2 and A-3 represent alternatives which satisfy the needs of the Proponent and the public and do not impose any significant environmental impacts. The benefits anticipated in the Transportation and Social Environment areas, are sufficient to identify A-3 as the better alternative. However, there are non-environment related questions surrounding integration of the TTC terminal facilities on the northwest quadrant within a private development. In addition, integration related questions are also evident for public-owned lands in the southeast quadrant. These could influence implementation of either A-3 or A-2 as a preferred alignment.

8.0 RECOMMENDATION FOR APPROVAL OF TWO ALTERNATIVES FOR ACHIEVING THE UNDERTAKING

- The Undertaking

A northward extension of the Spadina transit service is proposed, from Wilson Station to Sheppard Avenue.

The Undertaking comprises the construction and operation of an extension of the Spadina subway including a terminal station with related facilities including a widening of Sheppard Avenue near the Sheppard Avenue/Allen Road intersection.

- The Environmental Assessment Process

This environmental assessment process was conducted to determine the impact of the proposed extension and evaluate the alternatives in order to arrive at a preferred solution.

Normally, it is expected that the end result of this process will be a selection of one alternative as having the best overall potential for solving the problem.

In this study, eight (8) alternatives have been evaluated with six (6) being eliminated. The remaining two (2), namely Alignments A-2 and A-3, have been found to achieve better allround performance and to have lower environmental impact.

A close scrutiny of all environmental factors for alignment alternatives A-2 and A-3 yields a net benefit for A-3. The two transportation subfactors, external terminal accessibility and impact on the road system, along with the social environment benefits and cost considerations, are deemed to be more beneficial to the proponent and the public.

- Implementation Concerns

The Proponent, Toronto Transit Commission, does not want to limit its options to one alignment that may not be practical to implement on private property. This concern arises as a result of several non-environment factors which are outside the control of the Proponent. These are:

  - The cost and time factors associated with acquiring land may play a part in favouring one terminal site over another, due to present private/public ownership considerations and potential for some form of integrated commercial development on either site.
  - Planning approvals from North York cannot be prejudged. Time constraints, development scheduling and land acquisition could have an influence on implementation.

- Recommended Alternatives To Achieve the Undertaking

The Proponent has determined that Alternative A-3 is preferred over A-2, from the evaluation process, but considers it beneficial that both alternatives be brought forward to the end of the Environmental Assessment process for approval by MOE. In the event that A-3 cannot be implemented through a reasonable process of negotiation, thereby placing the public interest in jeopardy, A-2 would be selected as the preferred alternative.

Consequently, the Proponent requests approval of Alignments A-3 and A-2 as two, environmentally sound and satisfactory methods of achieving the Undertaking.

9.0 CUMULATIVE EFFECTS AND MITIGATION

The Ontario Ministry of Environment Guidelines note that:

- The EA Act requires a proponent to describe the actions necessary to "prevent, change, mitigate or remedy" the environmental effects of the undertaking and the alternatives (p.23)

- Wherever reasonable, proponents should also identify and evaluate the indirect and cumulative effects of alternatives.

Following is a discussion of environmental effects and mitigating measures associated with Alignments A-2 and A-3.

Projected Wayside Airborne Noise Levels Due to Rail Transit Operations

Alternatives A-2 and A-3 are expected to comply with the applicable noise criterion without applying any special mitigation measures.

Projected Ground-borne Noise and Vibration Levels Due to Rail Transit Operations

Alternatives A-2 and A-3 are expected to comply with the accepted vibration criterion with standard trackwork and trackbed.

Alternatives A-2 and A-3 will require the double tie trackbed system in order to keep noise within criteria limits. TTC normally uses the double tie trackbed system as a matter of policy in urban areas. Therefore, there will be no new noise or vibration levels in excess of accepted standards.[1]

---

[1] Wilson Ihrig & Associates Inc. Assessment of Noise and Vibration Impact for the Spadina Subway Extension Project. March, 1990.

Noise Assessment - Allen Station

Alternative A-2 has the station located in the southeast corner of the Allen Road and Sheppard Avenue intersection while in Alternative A-3, the station is located in the northwest corner of the intersection.

Both station locations create insignificant impact with respect to predicted increases in future noise levels due to traffic volumes, without a station. The northwest corner is located in a noise insensitive area with respect to immediate neighbours,[2] as opposed to the southeast corner where residences occur.

Ambient Air Quality

The existing air quality at the intersection of Allen Road and Sheppard Avenue is quite good. Emissions from vehicles at the intersection are the major contributors to the air quality impacts in the area. The predicted increase in emissions is due to the projected increase in traffic volumes and the queuing length and idling time increases, which introduce more vehicle exhaust into the ambient air. Air quality impacts due to the presence of the proposed station terminal were predicted to be minimal.

Therefore, cumulative effects are mostly due to increased traffic volume at the Sheppard Avenue/Allen Road Intersection and not to station terminal operations.[3] Hence no special mitigation measures are required at the terminal.

---

[2] Valcoustics Canada Ltd. Noise Impact Assessment - Allen Station. Technical Report #2: Proposed Spadina Subway Extension. June 19, 1990.

[3] RWDI. Final Report on Ambient Air Quality for the Spadina Subway Extension. June 13, 1990.

SPADINA SUBWAY EXTENSION
ENVIRONMENTAL ASSESSMENT

APPENDICES

APPENDIX 2.3

Public Participation Program Information

APPENDIX 2.3.1.
INFORMATION PRESENTED AT
PUBLIC INFORMATION CENTRE # 1

Board #	Title
A.	INTRODUCTION
1	Project Title
2	Purpose of the Meeting
3	The Undertaking
4	The Environmental Assessment Process
5	Information used in the Environmental Assessment Process
6	Project Work Flow
7	The Public Participation Process
B.	RATIONALE/NEEDS ANALYSIS
8	Existing Transit Network
9	Current Traffic Conditions
10	Travel Patterns
11	Future Network Possibilities
12	Alternatives to the Undertaking
13	Possible Alignments
C.	PLANNING ISSUES
14	Metropolitan Official Plan
15	North York Official Plan
16	Zoning Map
17	Land Use Map - Primary Study Area
18	Land Use Mix
19	Planning/Development/Land Use Factors being considered
D.	SOCIAL/CULTURAL/ECONOMIC ISSUES
20	Socio-Economic Factors being considered

21 Demographic Trends
22 Heritage/Archaeology

E. ENVIRONMENTAL ISSUES

23 Bio-physical factors being considered
24 Past Land Uses (Hydrogeology)
25 Environmental Sound and Vibration Studies
26 Air Quality Assessment

F. CONCLUSION

27. The next step - and further consultation

INFORMATION PRESENTED AT
PUBLIC INFORMATION CENTRE # 2

Board #	Title
A.	INTRODUCTION
1	Project Title
2	Purpose of the Meeting
3	The Undertaking
4	The Environmental Assessment Process
5	Information used in the Environmental Assessment Process
6	Project Work Flow
7	The Public Participation Process
B.	THE NEED TO IMPROVE THE TRANSIT NETWORK AND THE JUSTIFICATION FOR SUBWAY EXPANSION
6	The Roles of Rapid Transit Networks
7	Future Network Possibilities
8	Population and Employment Trends
9	Transportation Needs
10	Benefits
11	Land Use Implications
C.	ALTERNATIVES TOT HE SUBWAY EXTENSION
12	Alternatives for the Undertaking
13	Evaluation factors under COnsideration

D ALTERNATIVES FOR THE SUBWAY

14 "A" Series Alignments
15 "A" Series Alignments
16 "A" Series Alignments
17 "B" Series Alignments
18 Station Concepts

E. FINAL POINTS

19 Your Comments are Important
10 The Next Step

INFORMATION PRESENTED AT
PUBLIC INFORMATION CENTRE # 3

Board #	Title
1	Project Title
2	Purpose of the Meeting
3	Description of the Undertaking
4	E.A. Process
5	Overview
6	Alternatives for the Undertaking
7	Basis for Evaluation of Alternatives (response to problem statement)
8	Summary of Evaluation Findings
9	Alternative Alignments (Introductory-standards, etc.)
10	Alignments A-2 & A-3
11	Alignments A-1 & A-5
12	Alignments A-4 & A-6
13	Alignments B-1 & B-2
14	Station Configurations
15	Station Site Plans (2 sites)
16	Noise, vibration, Air Quality
17	Evaluation of Alignments • Transportation
18	Evaluation of Alignments • Social & Biophysical
19	Evaluation of Alignments • Land Use & Costs • Relative unweighed comparison
20	Problem Statement
21	Subway Network
22	Regional Population Trends, Public Comments Request

APPENDIX 2.3.2

2.3.2.1 Public Information Centre No. 1

PIC No. 1 was held at Faywood Elementary School on October 26, 1989, from 4:00 pm to 9:00 pm.

The objective of the meeting was to introduce the project background, the study team, and the constraints and opportunities of the project, in an effort to produce a meaningful dialogue and obtain public feedback as the study advances.

The invitation was to a 'drop-in' meeting. Delcan set up 27 displays panels (Appendix 2.3) and produced 100 brochures and 100 sets of reduced format copies of the 14 'text only' display panels. Forty-eight members of the public signed in, while in total about 53 attended.

In general terms visitors were:

- curious but completely uninformed both about the subway extension and EA process;
- relatively well informed with inquiries about their own properties in relation to the proposed undertaking; or
- very well informed on selected subjects - overall transport plans, the status of traffic north of Sheppard, etc. - and interested to see how the proposal would interact with those features.

Public concerns included:

- The Old Pond mine site ammunition dump remnant may be present;
- The design of Lionel-Groulx station in Montreal for transfers between services is worth reviewing;
- There is a need for parkland in view of proposed new housing.

Most people were in favour of subway extension or thought it should already have been done. They were also very interested in the precise alignment possibilities to be reviewed at the next stage and were anxious to be kept informed.

2.3.2.2 Public Information Centre No. 2

PIC No. 2 was held at Faywood Elementary School on December 12, 1989, from 4:30 to 9:30 pm

The objectives of the meeting were to make available to the public for review:

- statements concerning the need for the undertaking and justification for proceeding with it;
- the alternatives for the undertaking and an initial list of the factors on which they are to be evaluated; and
- alternative alignments for the subway and outline designs for the Sheppard Ave. terminal/interchange station.

The intent was to stimulate discussion and the input of ideas, comments on the exhibits, additional concerns and opinions.

The invitation was to a 'drop-in' meeting. Delcan displayed 20 panels (Appendix 2.3), and produced 60 brochures and 60 sets of 11 x 8 1/2 reduction of the 'Text Only' panels.
The visitors seemed relatively well informed concerning the Spadina Extension or related matters. Only eight comment sheets were received.

One citizen commented that information on the possible use of Metro land east of Allen Road for future subway yards should be provided on the displays at future centres.

There were no negative comments from the general public, with most being generally positive. The major comment was that the subway extension should have been done earlier.

2.3.3 Public Information Centre No. 3

PIC No. 3 was held at Faywood Elementary School on June 11, 1990, from 4:30 to 9:30 pm.

The objectives of the meeting were to provide for the public 23 panels for review and comment related to detailed evaluation of eight alignments and two station sites (Appendix 2.3). Ten (10) panels provided new displays of station detail and evaluation factors and methodology.

The invitation was to a drop in meeting with Delcan, TTC and TWC members present to answer questions.

Fifty (50) members of the public used the sign-in sheet. Twenty (20) comment sheets were left at the PIC. Members of the Technical Working Committee, Metro Council, TTC and a contingent of Idomo representatives also attended.

General Comment by the Public

- more electrically-run transportation (subway/LRT) can mean less air pollution (2 people)
- subway can solve problems of traffic congestion (3 people)
- prefer alternative Alignment A-2 over A-3 (10 people)
- prefer alternative Alignment A-3 over A-2 (4 people)
- potential for economic development that subway would encourage (3 people)
- in favour of subway extension (17 people)
- just want to be kept informed (3 people)

APPENDIX 2.3.3

MAILING LIST

SEND BY MAIL 30.05.90

Mr. Ron Coulas
Regional Director
Air Navigation Systems
Transport Canada

Mr. Ron Binnie
Regional Director General - Airports
Transport Canada

Ms. Linda Hoffman
Regional Director-Railway Safety
National Transportation Agency
Transport Canada

Mr. Jim Smith
Environment Canada (EPS Ontario)
Regional Screening and Coordinating Committee Chairman

Lt. Col. Barry Gateley
Canadian Forces Base, Toronto

Hon. Bob Kaplan
York Centre
House of Commons

Mr. R.H. Clendining
Director, Field Safety Branch
Ministry of Consumer & Commercial Relations

Mr. Peter Carruthers
Environmental Assessment Coordinator
Planning and Development Review Unit
Ministry of Culture and Communications

Ms. L. Ploeger
Manager, Industry Programs Section
Ministry of Energy

Honourable Ian Scott
Attorney General

Mr. N.L. Embree
Chief, Approvals and Planning
Ministry of the Environment
Central Region Office

Mr. David P. McHugh
Director, Land Management Branch
Ministry of Government Service

Mr. Tom Smith
Managing Director, GO Transit
Ministry of Transportation Ontario

Ms. Marcia Dofman
Director, Corporate Policy and planning Branch
Ministry of Housing

Mr. G.W. Fitzpatrick
Policy Co-ordinator
Office of Local Planning Policy

Mr. Arthur S. Holder
Regional Director, Central Region
Ministry of Natural Resources

Mr. R. C. Hodgins
Manager, Environmental Office
Highway Engineering Division
Ministry of Transportation

Hon. Monte Kwinter, M.P.P.

Mr. Nelson Melnyck
Manager - Corporate Planning
Toronto Transit Commission

Ms. Marjorie Wallens
Manager Public Affairs
Toronto Transit Commission

Mr. Richard Puccinni
Executive Director
Municipal Transportation Division
Ministry of Transportation Ontario

Mr. Tom Mulligan
manager, Transportation Division
Metropolitan Planning Department

Mr. Ray Taylor
Supervision of Planning and Liaison
Metro Ambulance

Barbara G. Caplan City Clerk
Clerk's Department
City of Toronto
City Hall

C. Rodrigo, Clerk
Clerks Department
City of York

R.S. Gillespie, City Clerk
City of Etobicocke

William Alexander, Clerk
Borough of East York

John Night, Clerk
City of Scarborough

Mr. Harry Fields
Ontario Coalition of Senior Citizens

Mr. Daid Pitt
MTACL

Ms. C. McPherson
People United for Self Help

Mr. D. Baker
Advocacy Resource Centre for the Handicapped

Miss Collen Weir
Transportation Co-ordinator
Women Plan Toronto

Mrs. Gerda Wekerle
Professor
Faculty of Environmental Studies
York University

Mrs. Pat Israel
Disable Women's Network

Mr. David Lacey, Chairman
Wheel-Trans COmmunity Committee

Ms. P. Marshal
Executive Director, METRAC

Ms. Samantha Chorney
Ontario Action Awareness

Ms. Ann Musgrave

Ms. Sheila Graham
Metro Toronto Association for Community Living

Ms. Maria Morse
Canadian Institute for Blind

Ontario March of Dimes

Mr. Kirby Rowe
Canadian Paraplegic Association

Armour Heights Community Association

Faywood and Vicinity Ratepayer's

Mr. Craig Mather
Manager, Water Resources Division & Region

Mr. A. Milliken Heisey
Kersner, Papazian, MacDermid, Metropolitan Toronto
Tremayne-Lloyd
Barristers and Solicitors

The Officer in Charge
32 Division, Metro Police

The Administrator
North York Historical Board

Mr. Allan Leach
General Manager
Toronto Transit Commission

Mr. Doug P. Floyd
Commissioner of Metro Toronto
Roads and Traffic

Mr. John Gartner
Commissioner of Planning
The Municipality of Metropolitan Toronto, East Tower

Mr. Dale R. Richmond
Chief Administrative Office
The Municipality of Metropolitan Toronto
City Hall

Mr. Fergy Brown, Major
City of York

Mr. Bruce Sinclair
Mayor
City of Etobicoke

Mr. Chris Stockwell
Councillor, Lakeshore-Queensway
City of Etobicoke

Mr. Dennis Flynn
Councillor, Kingsway-Hummer
City of Etobicoke

Mr. Dick O'Brian
Councillor, Markland-Centennial
City of Etobicoke

Mr. Lois Griffin
Councillor, Rexdale-Thristletown
City of Etobicoke

Mr. Dave Johnson, Mayor
Borough of East York

Mr. Joyce Trimmer
Mayor
City of Scarborough

Mrs. E. Geleff

CHRY-FM News Department

Mr. John Irwin

Mr. Craig Broderick
IBI Consultants Ltd.

Ms. Tammy Farber

Mr. Robert Fraser
Marketing Manager
Dufferin Construction

Mr. N. Nardi

Mr. Tom George
Canadian Paraplegic Association
Ontario Division

Ms. Joan Balch
J.B. Employ

Mr. Stephen F. Young, President
Mundet Industries

Mrs. Alyson C. Deans
Manager
Corporate Planning and Analysis
The Metropolitan Toronto and Region
Conservation Authority

Mr. Gerret W. Kavanagh
Account Executive Walwyn Stodgell Cochran Murray Ltd.

Ms. Joyce Main
BOOST

Mr. Peter Lambert

Mr. Terry Goodwin

Mr. David Leibold

Mr. K. Parn

Ms. Anne Nosov

Mr. David Allin
Ambulance Services

Mr.Paul Benetto

York Trillium Development Corp.

Concerned Citizens of North York

Mr. Glen Morris

SEND BY MAIL 01.06.90

City of Toronto
100 Queen Street West
2nd. Floor, Toronto, Ontario

Mr. Arthur Eggleton
Mayor, City of Toronto

Mr. Joe Pantalone
Councillor, Trinity-Niagara
City of Toronto

Mr. Derwin Shea
Councillor, High Park
City of Toronto

Mr. Richard Gilbert
Councillor, Davenport
City of Toronto

Ms. Anne Johnston
Councillor, North York
City of Toronto

Ms. Ila Bossoms
Councillor, Midtown
City of Toronto

Mr. Dale Martin
Councillor, Downtown
City of Toronto

Mr. Roger Hollander
Councillor, Don River
City of Toronto

Mr. Paul Christie
Councillor, East Toronto
City of Toronto

SENT BY COURIER 1-6-90

CITY OF NORTH YORK

5100 Yonge Street,
North York, Ontario
Att. : Mr. Wayne Guiney-Mail Room

Mrs. Elaine Hitchman
Community Planning Community
City of North York

Mr. Vince Murphy
Commissioner of Transportation
City of North York

Mr. Joe Gibson
Chief. North York Fire Department
City of North York

Mr. Brian Ruddy
Commissioner of Public Works
City of North York

Mr. Blair Macleod
City Clerk
City of North York

Mr. Mel Lastman
Mayor
City of North York

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B. Bradley
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P. Sutherland
North York Councillors Offices
City of North York

North York Councillors Offices
City of North York

North York Councillors Offices
City of North York

METRO COUNCIL

390 Bay Street, 5th Floor
Toronto, Ontario
Att. : Mr. Lawrence Muscat - Mail Room

Mr. Mario Gentile
Councillor, York-Humber
Metro Council

Mrs. Maria Augimeri
Councillor, Black Creek
Metro Council

Mr. Howard Noscoe
Councillor, North York Spadina
Metro Council

Mrs. Bev Salmon
Councillor, North York Centre South
Metro Council

Mr.Norman Garder
Councillor, North York Centre
Metro Council

Mrs. Marie Labatte
Councillor, Don Parkway
Metro Council

Ms. Joan King
Councillor, Seneca Heights
Metro Council

Mr. Alan Tonks
Councillor, York-Humber
Metro Council

Mr. Mike Colle
Councillor York-Eglinton
Metro Council

Mr. Peter Oyler
Councillor
East York
Metro Council

Mr. Brian Ashton
Councillor, Scarborough Bluffs
Metro Council

Ms. Maureen Prinsloo
Councillor, Scarborough Wexford
Metro Council

Mr. Brian Harrison
Councillor, Scarborough City Centre
Metro Council

Mr. Ken Morrish
Councillor, Scarborough Highland Creed
Metro Council

Mr. Scott Cavalier
Councillor, Scarborough-Agincourt
Metro Council

Mr. Bob Sanders
Councillor, Scarborough Malvern
Metro Council

FLIERS FOR PIC SPADINA EXTENSION
DELIVERED BY DIANA BAIRD - JUNE 1, 1990

Residential

Balmoral Estates

Bouring Walk	7, 11, 13, 17, 19, 23, 25, 29, 31, 35, 37, 14, 20, 90
Joel Swirsky Blvd.	28
Wilson Heights	477 - 481, 478 - 482
Clanton Ct.	16 - 26, 17 - 25
Reimer	246 - 278, 251 - 279
Findlay	5 - 55, 4 - 54
Embro	1, 2, 8 - 20, 7 - 21
Dufferin	3945 - 4001
Waterloo	340, 345

Royal Canadian Legion off Sheppard Avenue left batch for BB.
RCC (Hane) 640 Sheppard Avenue left batch for BB
William Lyon Mackenzie School left batch for BB

Bus/Residential/Other

Sheppard Avenue	915 - 927 (bus. with 4 res. above)
	910 - 916 (bus. with 4 res. above)
	929 - 943
	920 , 950 (now 1,000)
	1042 (16 appts. - left at mail boxes)
	1020 - 1028, 1032 - 36, 1040
CFB Downsview	Left flyers at Transport Depot based closed for Sports Day.

Businesses - Industrial Park off Sheppard Avenue who received Flyers - June 1, 1990.

Cosmoda Design Inc.
Artus International Ltd.
Astro Sportswear Ltd.
York Manufacturing & Silk Screening Co.
Mountbriar Building Corporation Limited
V. Macri Enterprises Inc.Computer EMporium
Kodiak Gallery
Avanti Fine Cars
Numatics Ltd.
East West Plastic
Alert Glass & Mirror Ltd.
CREAVA Communications
Danbury Office Interiors
Head Office Reference Laboratory
Rubenstein Bros, (Ont.) Inc.
National Pagette
Tri-Mar Office Supplies
M. Angel Surplus Machinery

Network Realty Ltd.
ALpha Dental Supplies
Beverly Hills Motorcar Co. Ltd.
Doors & Windows Unlimited Ltd.
The ACM Group
Model Jewellery Mfg. Co. Ltd.
Public Optical
Philip Fitzpatrick
Kyll Electronics Company
Kadima Group
Frank's Swim School
DOC-Desktop Office Concepts
The Home Shoppe
Imperial Coffee

APPENDIX 2.3.4

DELCAN
ENGINEERS
PLANNERS
ARCHITECTS

February 12, 1990

Our Ref: 01-2756D

Mrs. Judi Cohen, Superintendent,
Environmental Assessment and Research
Toronto Transit Commission
1900 Yonge Street
Toronto, Ontario
M4S 1Z2

Mrs. Cohen:

RE: CONTACTS WITH RATEPAYERS/SPADINA SUBWAY EXTENSION

Enclosed please find details of our communications with the ratepayers associations situated in the vicinity of the proposed Spadina subway extension project. While we have spoken with a majority of these groups, there remain a number of contacts which will have to be made outside of business hours over the course of the next two weeks.

The listing of associations was assembled from three sources:

1) our existing list, which included the Armour Heights Community Association and the Faywood and Vicinity Ratepayers Association, the two associations situated in closest proximity to the proposed extension;

2) a list of all ratepayers associations in wards three, five and seven provided by the North York Public Information Centre; and,

3) telephone contacts with the offices of respective ward councillors to ensure the accuracy of the overall listing.

In considering the interim results, please note that the associations listed offer only limited coverage of the areas of concern in the vicinity of the proposed extension. Furthermore, only one association, the Faywood and Vicinity Ratepayers Association, is located in close proximity to the localized area of projected immediate impact.

- While most people we spoke to were aware of the discussions surrounding the proposed Sheppard Subway, none had heard specifically of the proposed Spadina extension. Many could not account for the lack of awareness, although a number of reasonable explanations were advanced:

    1) a large undertaking such as the extension is not an appropriate ratepayer issue;

    2) the public is generally in favour of the subway extension; and,

    3) the public is becoming apathetic to mass transportation issues due to a lack of progress in this area.

DELCAN CORPORATION
133 WYNFORD DRIVE, NORTH YORK, METROPOLITAN TORONTO CANADA, M3C 1K1 • (416) 441-4111
TELEX 06-9666-89 • FAX (416) 441-4131

ST JOHN'S, MONTREAL, OTTAWA, HAMILTON, NIAGARA FALLS, LONDON, THUNDER BAY, WINNIPEG, REGINA, SASKATOON, CALGARY, VICTORIA, VANCOUVER

Our interaction with the ratepayers to date can be summarized as follows:

- All of the ratepayers we contacted spoke in favour of any subway expansion, as a result of positive perceptions of future reductions in congestion and increased accessibility. In considering this, please note that despite leaving a number of messages, we have not yet received a response from the Faywood and Vicinity Ratepayers Association identified above. This may be due to the fact that they were informed of previously held public information centres.
- Most groups have not organized meetings for a long time. All of the persons contacted were interested in receiving information. Many said that they now plan to discuss the matter with their membership and provide input through written submissions and attendance at the next public information centre.

I trust this is to your satisfaction.

Yours sincerely,

Ron Yachnin

Ron Yachnin

RWY/sai

Attach.

cc: L. Erskine
B.I. Lamb

LIST OF CONTACTS
RATEPAYERS ASSOCIATION
SHEPPARD SUBWAY-SPADINA EXTENSION
ENVIRONMENTAL ASSESSMENT

Ratepayers Associations

Mr. Attilio Didiano, President
FIRGROVE HOMEOWNERS ASSOCIATION
207 Firgrove Crescent
North York, Ontario
743-5219 (Res.)
740-8723 (Bus.)

Mary Cicogna, President
FUTURA/GRANDRAVINE RATEPAYERS ASSOCIATION
50 Futura Drive
North York, Ontario
M3N 2L7
636-6399 (Res.)
222-8282 (Bus.)

Orsola Cuguari, President
HULLMAR HOMEWNERS ASSOCIATION
61 Blacksmith Crescent
North York, Ontario
M3N 1V5
663-3470 (Res.)

Nick DiLena, Secretary
NORTHWOOD HOMEOWNERS ASSOCIATION
56 Clubhouse Crt.
North York, Ontario
M3L 2K5
636-8167 (Res.)

Mr. John Wilson, Treasurer
UNIVERSITY VILLAGE RATEPAYERS ASSOCIATION
39 Laskay Crescent
North York, Ontario
M3N 1P2
663-0178 (Res.)

Mr. Angelo Natale, President
YORKWOODS RATEPAYERS ASSOCIATION
747-9112 (bus)

Mr. Peter DePaolis, President
WILMONT/FORGE HOMEOWNERS ASSOCIATION
9 Strong Court
North York, Ontario
M3N 1N8
661-1806 (Res.)

Mr. Norm Kelly
UNIVERSITY CITY COMMUNITY ASSOCIATION
661-2253 (Res.)

Mr. Bob Rovazzi, President
RODING RATEPAYERS ASSOCIATION
54 Dovorking Crescent
Downsview, Ontario
M3M 2B6

Mr. Stone, Vice President
ANTIBES TORRESDALE RATEPAYERS ASSOCIATION
80 Antibes Drive - Apt. 2006
Willowdale, Ontario
M2R 3T2

Ms. Maureen Simpson Van Nord, Secretary
ANTIBES TORRESDALE RATEPAYERS ASSOCIATION
133 Torresdale Avenue
North York, Ontario
M2R 3T2
663-5727
928-6233

Ms. Rhoda Moldofsky
BATHURST VILLAGE RATEPAYERS ASSOCIATION
211 Torresdale Avenue
North York, Ontario
667-9979 (Res.)
928-6233 (Bus.)

Mr. Bernardino Spenseri
FAYWOOD & VICINITY RATEPAYERS ASSOCIATION
195 Faywood Blvd.
North York, Ontario
M3H 2Y2
638-5298 (Res.)
749-0312 (Bus.)

Mr. Roman D. Serbinski
FINCH FRONT OWNERS ASSOCIATION
159 Finch Avenue West
North York, Ontario
M2N 2J1
222-6521 (Res.)
733-1616 (Bus.)

Mr. Richard Levine
RIDGEGATE RATEPAYERS ASSOCIATION
225 Hidden Trail
North York, Ontario
M2R 3T3
665-3437 (Res.)
229-3769 (Bus.)

Ms. Katalin Coorsh
ROSSLORD COMMUNITY ASSOCIATION
148 Robert Hicks Drive
North York, Ontario
M2R 3R5
665-3129 (Res.)
222-8022 x227 (Bus.)

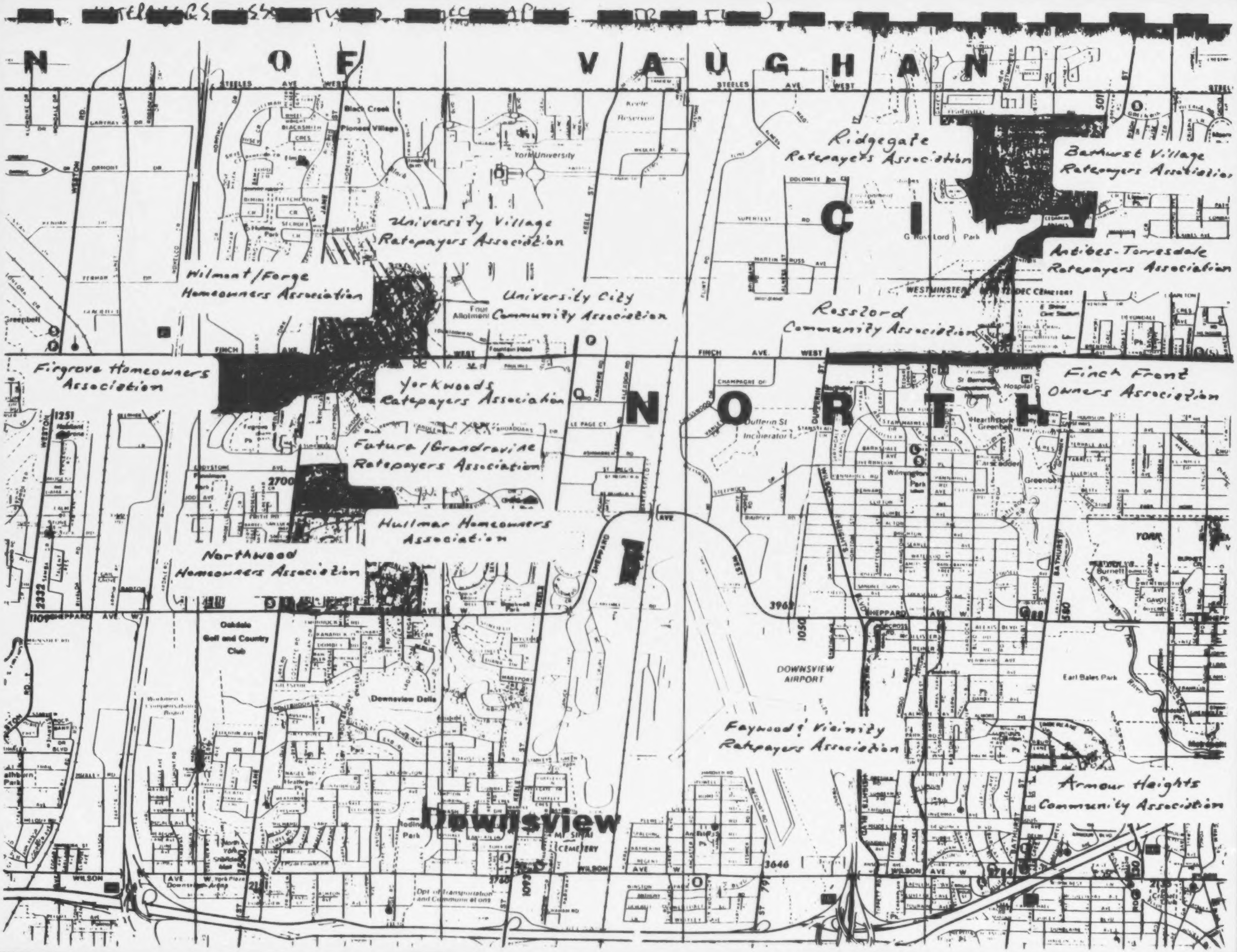
Mr. Irving Charny, President
ARMOUR HEIGHTS COMMUNITY ASSOCIATION
208 Armour Boulevard
North York, Ontario
M3H 1M7
633-4147 (Res.)

Ward Councillors

Mr. P. Lipreti
Ward 3
North York Councillors Offices
City of North York
5100 Yonge Street
North York, Ontario
M2N 5V7
224-6032

Mr. A. Perruzza
Ward 5
North York Councillors Offices
City of North York
5100 Yonge Street
North York, Ontario
M2N 5V7
224-6019

Mr. I. Chapley
Ward 7
North York Councillors Offices
City of North York
5100 Yonge Street
North York, Ontario
M2N 5V7
224-6020


CITY OF VAUGHAN
CITY OF NORTH YORK
Ridgegate Ratepayers Association
Bathurst Village Ratepayers Association
University Village Ratepayers Association
Antibes-Torresdale Ratepayers Association
Wilmont/Forge Homeowners Association
University City Community Association
Rosslord Community Association
Firgrove Homeowners Association
Yorkwoods Ratepayers Association
Finch Front Owners Association
Future/Grandravine Ratepayers Association
Hullmar Homeowners Association
Northwood Homeowners Association
Faywood & Vicinity Ratepayers Association
Armour Heights Community Association
Downsview
DOWNSVIEW AIRPORT
York University
Black Creek Pioneer Village
Oakdale Golf and Country Club
Downsview Dells
Earl Bales Park
G Ross Lord Park
STEELES AVE WEST
FINCH AVE WEST
SHEPPARD AVE W
WILSON AVE W
WESTON RD
JANE ST
KEELE ST
DUFFERIN ST
BATHURST ST
YONGE ST

DELCAN

CALL REPORT

To : **Ms. Mary Cicogna**
Futura/Grandravine Ratepayers Association

From : **Ronald Yachnin, M.A.**
Planner

Date : **January 26, 1990**

Re.: **Sheppard Subway-Spadina Extension Environmental Assessment**

- The association has not met in a long time
- They have no opinion on the subway extension
- Please send information

RY:ma
cc.: Mrs. Judi Cohen
Ms. Barbara Lamb
Mr. Lynton Erskine

DELCAN

CALL REPORT

To : **Ms. Orsola Cuguari**
Hullmar Homeowners Association

From : **Ronald Yachnin, M.A.**
Planner

Date : **January 31, 1990**

Re.: **Sheppard Subway-Spadina Extension Environmental Assessment**

- Have not heard about extension, only east-west line
- Thinks people in community would definitely like that idea : buses crowded, ease traffic, better links to downtown
- Send information and will schedule ratepayer meeting to discuss
- Will send copy of meeting minutes to Delcan and arrange to have some people attend the next Public Information Centre

RY:ma
cc. : Mrs. Judi Cohen
Ms. Barbara Lamb
Mr. Lynton Erskine

DELCAN

CALL REPORT

To : **Mr. Attilio Didiano**
Firgrove Homeowners Association

From : **Ronald Yachnin, M.A.**
Planner

Date : **January 26, 1990**

Re.: **Sheppard Subway-Spadina Extension Environmental Assessment**

- Thinks the extension is a good idea
- Has not heard anything about the meetings
- Requests information
- Will send letter of support after reviewing information
- Would be interested in coming to a meeting

RY:ma
cc. : Mrs. Judi Cohen
Ms. Barbara Lamb
Mr. Lynton Erskine

DELCAN

CALL REPORT

To : **Mr. Richard Levine**
Ridgegate Ratepayers Association

From : **Ronald Yachnin, M.A.**
Planner

Date : **January 26, 1990**

Re.: **Sheppard Subway-Spadina Extension Environmental Assessment**

. Not aware of proposed undertaking

. Subway not a general ratepayer concern

. Send information, will post

RY:ma
cc. : Mrs. Judi Cohen
Ms. Barbara Lamb
Mr. Lynton Erskine

DELCAN

CALL REPORT

To : **Ms. Rhoda Moldofsky**
Bathurst Village Ratepayers Association

From : **Ronald Yachnin, M.A.**
Planner

Date : **January 25, 1990**

Re.: **Sheppard Subway-Spadina Extension Environmental Assessment**

- Not aware of project
- Requests information
- Will prepare submission
- claims positive perception

RY:ma
cc. : Mrs. Judi Cohen
Ms. Barbara Lamb
Mr. Lynton Erskine

DELCAN

CALL REPORT

To : **Ms. Maureen Simpson-Van Nord**
Antibes Torresdale Ratepayers Association

From : **Ronald Yachnin, M.A.**
Planner

Date : **January 25th., 1990**

Re.: **Sheppard Subway-Spadina Extension Environmental Assessment**

. Last meeting one year ago

. No opinion on subway at this point

. Will consult with President regarding formal written submission

RY:ma
cc.: Mrs. Judy Cohen
Ms. Barbara Lamb
Mr. Lynton Erskine

DELCAN

CALL REPORT

To : **Mr. Roman Serbinski**
Finch Front Owners Association

From : **Ronald Yachnin, M.A.**
Planner

Date : **January 31, 1990**

Re.: **Sheppard Subway-Spadina Extension Environmental Assessment**

- Aware of discussions surrounding Sheppard Subway but not north-south extension
- Mass transportation is one of the most overstudied issues ever faced by our agency. This may be one reason for public apathy. The public may be losing faith as a result of the lack of progress.
- Thinks the extension is a very good idea
- Would have liked to respond in the past had they been given the opportunity. Will respond following the receipt of information and attend next Public Information Centre.

RY:ma
cc. : Mrs. Judi Cohen
Ms. Barbara Lamb
Mr. Lynton Erskine

DELCAN

ENGINEERS
PLANNERS
ARCHITECTS

January 26, 1990

Ms. Mary Cicogna
Futura/Grandravine Ratepayers Association
50 Futura Drive
North York, Ontario
M3N 2L7

Dear Ms. Cicogna :

Re.: **Shepard Subway-Spadina Extension Environmental Assessment**

As discussed during the recent telephone conversation with Ron Yachnin, we have enclosed background information pertaining to the environmental assessment of the Spadina Subway Extension. This consists mainly of material presented at the two Public Information Centres held during 1989.

Should you, or any of your members, have any questions or comments regarding the proposed undertaking, please do not hesitate to contact us.

Thank you.

LErskine

Lynton Erskine, P.Eng.
Project Manager

Encl.
cc.: Mrs. Judi Cohen, Superintendent
Environmental Assessment and Research
Toronto Transit Commission

DELCAN CORPORATION

133 WYNFORD DRIVE, NORTH YORK, METROPOLITAN TORONTO CANADA, M3C 1K1 • (416) 441-4111
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CALGARY VICTORIA VANCOUVER

DELCAN ENGINEERS PLANNERS ARCHITECTS

January 26, 1990

Ms. Orsola Cuguari
Hullmar Homeowners Association
21 Blacksmith Crescent
North York, Ontario
M3N 1V5

Dear Ms. Cuguari :

Re.: Sheppard Subway-Spadina Extension Environmental Assessment

As discussed during the recent telephone conversation with Ron Yachnin, we have enclosed background information pertaining to the environmental assessment of the Spadina Subway Extension. This consists mainly of material presented at the two Public Information Centres held during 1989.

Should you, or any of your members, have any questions or comments regarding the proposed undertaking, please do not hesitate to contact us.

Thank you.

L.J. Erskine

Lynton Erskine, P.Eng.
Project Manager

Encl.
cc.: Mrs. Judi Cohen, Superintendent
Environmental Assessment and Research
Toronto Transit Commission

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ENGINEERS
PLANNERS
ARCHITECTS

January 26, 1990

Mr. Attilio Didiano, President
Firgrove Homeowners Association
207 Firgrove Crescent
North York, Ontario
M3N 1K7

Dear Mr. Didiano :

Re.: **Sheppard Subway-Spadina Extension Environmental Assessment**

As discussed during the recent telephone conversation with Ron Yachnin, we have enclosed background information pertaining to the environmental assessment of the Spadina Subway Extension. This consists mainly of material presented at the two Public Information Centres held during 1989.

Should you, or any of your members, have any questions or comments regarding the proposed undertaking, please do not hesitate to contact us.

Thank you.

L.J. Erskine

Lynton Erskine, P.Eng.
Project Manager

Encl.
cc.: Mrs. Judi Cohen, Superintendent
Environmental Assessment and Research
Toronto Transit Commission

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PLANNERS
ARCHITECTS

January 26, 1990

Mr. Richard Levine
Ridgegate Ratepayers Association
225 Hidden Trail
North York, Ontario
M2R 3T3

Dear Mr. Levine

Re.: Sheppard Subway-Spadina Extension Environmental Assessment

As discussed during the recent telephone conversation with Ron Yachnin, we have enclosed background information pertaining to the environmental assessment of the Spadina Subway Extension. This consists mainly of material presented at the two Public Information Centres held during 1989.

Should you, or any of your members, have any questions or comments regarding the proposed undertaking, please do not hesitate to contact us.

Thank you.

L. J. Erskine

Lynton Erskine, P.Eng.
Project Manager

Encl.
cc.: Mrs. Judi Cohen, Superintendent
Environmental Assessment and Research
Toronto Transit Commission

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CALGARY VICTORIA VANCOUVER

DELCAN ENGINEERS
PLANNERS
ARCHITECTS

January 26, 1990

Ms. Maureen Simpson Van-Nord
Antibes Torresdale Ratepayers Association
133 Torresdale Avenue
North York, Ontario
M2R 3T2

Dear Ms. Simpson Van-Nord:

Re.: **Sheppard Subway-Spadina Extension Environmental Assessment**

As discussed during the recent telephone conversation with Ron Yachnin, we have enclosed background information pertaining to the environmental assessment of the Spadina Subway Extension. This consists mainly of material presented at the two Public Information Centres held during 1989.

Should you, or any of your members, have any questions or comments regarding the proposed undertaking, please do not hesitate to contact us.

Thank you.

L. Erskine

Lynton Erskine, P.Eng.
Project Manager

Encl.
cc.: Mrs. Judi Cohen, Superintendent
Environmental Assessment and Research
Toronto Transit Commission

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CALGARY VICTORIA VANCOUVER

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PLANNERS
ARCHITECTS

January 26, 1990

Ms. Rhoda Moldofsky
Bathurst Village Ratepayers Association
211 Torresdale Avenue
North York, Ontario
M2R 3E7

Dear Ms. Moldofsky :

Re.: Sheppard Subway-Spadina Extension Environmental Assessment

As discussed during the recent telephone conversation with Ron Yachnin, we have enclosed background information pertaining to the environmental assessment of the Spadina Subway Extension. This consists mainly of material presented at the two Public Information Centres held during 1989.

Should you, or any of your members, have any questions or comments regarding the proposed undertaking, please do not hesitate to contact us.

Thank you.

L. J. Erskine.

Lynton Erskine, P.Eng.
Project Manager

Encl.
cc.: Mrs. Judi Cohen, Superintendent
Environmental Assessment and Research
Toronto Transit Commission

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CALGARY VICTORIA VANCOUVER

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ENGINEERS
PLANNERS
ARCHITECTS

January 30, 1990

Mr. Roman D. Serbinski
Finch Front Owners Association
159 Finch Avenue West
North York, Ontario
M2N 2J1

Dear Mr. Serbinski:

Re.: Sheppard Subway-Spadina Extension Environmental Assessment

As discussed during the recent telephone conversation with Ron Yachnin, we have enclosed background information pertaining to the environmental assessment of the Spadina Subway Extension. This consists mainly of material presented at the two Public Information Centres held during 1989.

Should you, or any of your members, have any questions or comments regarding the proposed undertaking, please do not hesitate to contact us.

Thank you.

L. Erskine

Lynton Erskine, P.Eng.
Project Manager

Encl.
cc.: Mrs. Judi Cohen, Superintendent
Environmental Assessment and Research
Toronto Transit Commission

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CALGARY VICTORIA VANCOUVER

APPENDIX 37

AIR QUALITY STUDY REPORT

RWDI

Rowan Williams
Davies & Irwin Inc.

FINAL REPORT ON AMBIENT AIR QUALITY
FOR THE
SPADINA SUBWAY EXTENSION
DOWNSVIEW, ONTARIO

Report 9011262
June 13, 1990

Submitted to:
DELCAN CORPORATION
NORTH YORK, ONTARIO

By:
ROWAN WILLIAMS DAVIES & IRWIN Inc.
GUELPH, ONTARIO

Michael C Murphy
Michael C. Murphy, Ph.D., P.Eng.
Air Quality Specialist

for Anton E. Davies, Ph.D., P.Eng.
Principal

650 Woodlawn Road West, Guelph, Ontario N1K 1B8 • Fax (519) 823-1316, Tel. (519) 823-1311

EXECUTIVE SUMMARY

Rowan Williams Davies & Irwin Inc. (RWDI) was retained by Delcan Corporation to perform dispersion modelling to assess the air quality impacts from construction of a bus terminal at the intersection of Sheppard Avenue and Allen Road, in North York, Ontario. The impact of the terminal on its own was established by comparing dispersion modelling results with and without the terminal in place using future traffic volumes. The air quality impacts were predicted with the California Line Source model CALINE-4, and were based on traffic information supplied to RWDI by Delcan. Existing conditions were based on monitoring data from nearby Ministry of the Environment (MOE) monitoring stations. Both existing and predicted data were compared with the MOE 1-hour Ambient Air Quality Criteria for carbon monoxide (CO) and nitrogen dioxide (NO_2). In the existing case, the measured air quality data were always below the criteria. In the future case, the air quality impacts at the intersection of Sheppard and Allen as predicted by dispersion modelling were found to approach and exceed the criteria in some cases. With respect to CO, the predicted concentrations were found to approach the 1-hour CO criterion at several locations and exceed it at one location. Based on the 1-hour air quality levels and the variation in traffic volumes through the day, the potential for the MOE 8-hour criterion for CO to be exceeded is also high. With respect to nitrogen dioxide, at an assumed 10% coversion rate of nitric oxide (NO) to nitrogen dioxide (NO_2), the NO_2 concentrations at several receptor locations were close to the 1-hour criterion and an exceedance was predicted at one location. At an assumed 25% conversion rate, the NO_2 concentrations exceeded the criterion at several locations. Although the true conversion rate is somewhat uncertain (somewhere between 10 and 25%), the predicted concentrations indicate that the potential for the MOE 1-hour criterion to be exceeded is high. The assessment is strongly dependent on weather conditions and traffic flows. In summary, the air quality was predicted to be poor to moderate in this worst case scenario as a result of emissions from vehicle traffic at the intersection, and not a consequence of additional traffic due to the bus terminal. The air quality impacts due to the presence of the bus terminal alone at either the northwest or southeast sites were predicted to be minimal.

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1. INTRODUCTION

Rowan Williams Davies & Irwin Inc. (RWDI) was retained by Delcan Corporation to conduct an air quality assessment of the proposed Toronto Transit Commission (TTC) Bus Terminal to be located at the intersection of Sheppard Avenue and Allen Road, just east of the Downsview Airport. The bus terminal is associated with the proposed Spadina Subway Extension and will serve as passenger support to and from the subway station. The objective of the study was to determine the air quality impacts of emissions from additional traffic and bus movement in the area near the proposed site resulting from the bus terminal only. The assessment of air quality consisted of examining ambient air concentration data from nearby Ministry of the Environment (MOE) monitoring stations, as well as predicting air quality impacts due to the construction and operation of the bus terminal at either the northwest corner or the southeast corner of the intersection. The main source of concern near the site was vehicle traffic queuing at the intersection during the peak traffic periods. Specifically, the air quality impacts of additional vehicle and bus traffic due to the presence of the terminal were assessed.

2. METHODOLOGY

Personnel from RWDI conducted a site visit to the intersection of Sheppard Avenue and Allen Road on September 28, 1989. Photos of the intersection are shown in Figure 1 looking from the northeast corner of the intersection toward the south and southwest. The site consists of mostly clear grassland with some residential buildings to the north and east.

The existing air quality at the intersection of Sheppard Avenue and Allen Road was assessed by examining data from the two monitoring stations nearest the intersection. These stations, operated by the Ontario Ministry of the Environment (MOE), were brought on line in June of 1988. Data from June to December 1988 were obtained from the MOE by personal communication with Mr. Phil Kiely at the Air Quality Assessment and Instrumentation Unit of the Air Resources Branch of the MOE. At the time of the request, the data were not available in final report form, so the data were communicated verbally. These data are presented in Tables 1 and 2, and have since been published by the MOE [1].

Emissions from roadway traffic were assessed using numerical modelling techniques. The vehicle emissions model MOBILE-4 [2] was used to calculate emission rates of carbon monoxide (CO) and nitrogen oxides (NOx) from traffic at the intersections Sheppard Avenue-Allen Road and Sheppard Avenue-Banting Avenue. Due to the uncertainty of the emission rates in the year 2010 and the traffic counts in that year, the analysis was carried out for the year 1995 since more reasonable projections for this year were available. The peak A.M. traffic volumes were used in the analysis. Other assumptions used in the modelling were:

- peak period operating speed is 50 km/h with an approach speed of 25 km/h;
- traffic breakdown on the major routes was proportioned into a general mix of vehicles;
- ambient temperature = -10 degrees Celsius;
- roadway lane widths = 3.6 m;
- cycle time for the lights at the Allen-Sheppard intersection = 130 seconds;
- for the new intersection into the bus terminal on Sheppard east of Allen, the cycle time for the lights = 100 seconds;
- the bus terminal was modelled to include 1995 bus volumes, parking for 350 vehicles and kiss n' ride for 380 vehicles during peak A.M. traffic;
- a new left turn and right turn lane was constructed for the bus terminal intersection;
- background concentrations: CO was assumed to be 5 ppm, and NO_2 was assumed to be 0.10 ppm; these are representative of background in the Metro Toronto area;
- the conversion of NO to NO_2 is complex but is strongly dependent on available sunlight and local ozone concentration; based on past experience, a reasonable range is 10 to 25% conversion; both have been considered in the following analysis;

Two cases were studied both using peak hour traffic data supplied by Delcan. These included assessing the scenarios i) with and ii) without the bus terminal and car park in place using future (1995) traffic data. The future traffic numbers were estimated by RWDI by simply pro-rating the 1986 data shown in Figure 2, as advised by Delcan, to arrive at the 1995 numbers as illustrated in Figure 3. The weighting was based on the total traffic volumes predicted by Delcan for 1995, and split among left turns, straight throughs, and right turns respectively. The locations of the receptors are shown in the site plan of Figure 3, and the traffic numbers for both intersections studied (Sheppard-Allen and Sheppard-Banting) are presented in the expanded intersection plans as presented in Figure 3.

The traffic data, emission factors and geometrical information were used as input to a numerical dispersion model called CALINE-4 (California Line Source, version 4) [3] to predict peak concentrations of nitrogen dioxide (NO_2) and carbon monoxide (CO) for the worst case conditions. The results are presented for the worst-case conditions in the area: a stable environment, cool temperatures, low wind speed, and light cycle times affecting queueing lengths.

3. RESULTS AND DISCUSSION

3.1 Existing Conditions

Data from the two local Ministry of the Environment monitoring stations are shown in Table 1. The North York Central monitoring station is located approximately 2.8 km to the northeast of the Sheppard-Allen Intersection, at Hendon and Yonge, near the car park for the nearby subway. The North York West monitor is located at 35 Edgar Avenue, near the intersection of major highways 400 and 401 and is approximately 3.5 km to the west of the study site. One important point to consider about this station is that the monitor is located close to the intersection of a major freeway and thus data taken here will reflect the much larger number of vehicles contributing to the air quality problem. Based on similar traffic patterns, air quality at the study site (Sheppard-Allen intersection) would most likely be best reflected by the data from the North York Central monitoring station.

A comparison of the data in Table 1 shows that contaminant levels for the annual mean were consistently higher (and near double in some cases) at the North York West station compared with North York Central. When compared with the MOE Ambient Air Quality Criteria presented in Table 2 there were no exceedances of the sulphur dioxide (SO_2), carbon monoxide (CO), or nitrogen dioxide (NO_2) criteria during the six month monitoring period. However, the ozone (O_3) 1-hour criteria was exceeded 154 times at North York Central and 84 times at North York West. The Soiling Index (which considers particles of size less than 10 microns) 24-hour criteria was exceeded 2 times an North York Central and 5 times at North York West.

With the exception of ozone and suspended particles, the air quality over the six month period June-December 1988 was always within the Ministry's Criteria. It should be noted that ozone is a regional problem and is generally not site specific within an urban area.

As expected, the air quality at the monitoring station near the freeway was significantly poorer than at Yonge and Hendon for the carbon monoxide and nitrogen oxide gases because of the much higher level of traffic. Since traffic patterns at North York Central and the study site are similar, the air quality is expected to be similar. Thus, it is deduced that the existing Air Quality at the intersection of Sheppard Avenue and Allen Road is quite good. Except for suspended particles and ozone, the MOE ambient air quality criteria are not expected to be exceeded at the existing site.

3.2 Air Quality with the Bus Terminal in Place

The predicted concentrations for both CO and NO_2 are presented in Table 3. The CO concentrations at locations near the intersection, e.g. Receptors 15 and 16, were predicted to be very close to the 1-hour MOE criterion. The concentration at receptor 13 exceeded the 1-hour 30 ppm criterion with the wind blowing from the west (270 degrees). The main reason for this is the queueing of vehicles at the intersection. With increased traffic volumes, the queueing length and idling time increases thereby introducing more vehicle exhaust into the ambient air. In the future, CO emissions from vehicles are expected to decrease significantly as set forth by government guidelines. Thus, if traffic does not increase significantly over the next 20 years then the future concentrations of CO will likely be lower than those predicted. At locations away from the intersections, the concentrations were predicted to satisfy the MOE 1-hour CO criterion, but the concentrations were relatively high. The frequency of exceeding the 1-hour CO criterion (30 ppm) was not assessed in this study.

The concentrations of NO_2 were predicted for both conversion rates (10% and 25%) and are presented in Table 3. At a 25% conversion, the NO_2 concentrations were predicted to equal or exceed the 1-hour NO_2 criterion of 0.2 ppm at several locations. At 10% conversion, one exceedance was found at receptor 13. Also, concentrations at several other receptor locations were found to approach the 1-hour NO_2 criteria. Again, these locations were near the intersections. At peak traffic times under worst case conditions, the air quality is thus expected to be poor to moderate.

Another important point is that the traffic counts for 1986 seem to indicate that traffic volumes during off-peak hours do not decrease significantly. If the recommended method for calculating concentrations at different averaging times is used [4], then exceedances of the more stringent 8-hour CO criterion are likely.

Emissions from vehicles at the intersections are the major contributors to the air quality impacts in the area. Therefore the option of moving the bus terminal to the NW corner of the Allen-Sheppard intersection is not expected to significantly affect the surrounding air quality. A slight improvement in air quality may be realized because of a lower vehicle density associated with separating the parking vehicles area from the bus terminal area.

3.3 Predicted Air Quality without the Bus Terminal

The numerical model was run with future traffic and without the bus terminal (Refer to Table 4). In this configuration the Sheppard-Banting intersection was assumed to exist in the 1986 configuration with no roadway onto the site. The changes in predicted concentrations from the case with the bus terminal in place were very small. The largest difference (1.8 ppm CO) occurred at receptor 9 just off Banting Ave. As expected, the emissions from vehicles at the intersections are the major contributors to the air quality impacts in the area near the intersections.

3.4 Air Quality Impacts Due to Bus Terminal

Since the change in predicted concentrations for the two configurations were very small, it may be concluded that the air quality impacts due to the presence of the proposed bus terminal will be minimal. Thus, although the air quality was predicted to be approaching (and exceeding in some cases) the MOE criteria in this worst case scenario, the air quality impact due to the presence of the bus terminal and car park at the proposed Sheppard-Allen site is expected to be low.

4. CONCLUSIONS AND RECOMMENDATIONS

Based on the assumptions and subsequent analyses described above our conclusions are:

1) The air quality at the intersection of Sheppard and Allen was predicted to approach (and exceed in some cases) the Ministry of Environment Criteria for carbon monoxide (CO) and nitrogen dioxide (NO_2).

2) The air quality impacts due to the presence of the proposed bus terminal were predicted by numerical modelling to be minimal.

3) The assessment is strongly dependent on choice of weather conditions and traffic flows.

4) A slight improvement in air quality may be realized because of a lower vehicle density associated with separating the parking vehicles area from the bus terminal area.

5) In the event that additional development of the site may be approved, further assessment is recommended due to changes in traffic flows. If the bus terminal is to be enclosed, additional assessment of the indoor ventilation requirements is strongly recommended.

7. REFERENCES

1. Ontario Ministry of the Environment, Air Quality in Ontario 1988, A Review of the Air Quality Monitoring Program, the 1988 Annual Summary, Queen's Printer for Ontario, 1990.

2. Compilation of Air Pollutant Emission Factors, Volume II: Mobile Sources, AP-42, 4th Edition, September, 1985, U.S. Environmental Protection Agency.

3. CALINE-4 A Dispersion Model for Predicting Air Pollutant Concentrations Near Roadways, Revised Nov. 1986, Report No. FHWA/CA/TL-84/15, State of California, Department of Transportation, Division of Construction, Office of Transportation Laboratory.

4. Discussion Paper, Air Pollution - General Regulation (Regulation 308), Ontario Ministry of the Environment, November, 1987, Appendix C.

	North at Hendon	York - Yonge	Central (near car park)	North 35 Edgar highways	York Avenue 400 and	West (near 401)
	Peak 1-hour (ppm)	Peak 24-hour[1] (ppm)	Annual Mean (ppm)	Peak 1-hour (ppm)	Peak 24-hour[1] (ppm)	Annual Mean (ppm)
SO_2	0.10	0.04	0.005	0.11	0.04	0.009
CO	10.0	6.0	0.8	9.0	6.0	1.2
O_3	0.177	0.073	0.021	0.124	0.063	0.0159
NO_2	0.10	0.05	0.019	0.14	0.09	0.038
NO	0.43	0.20	0.025	0.53	0.30	0.045
NOx	0.53	0.25	0.044	0.67	0.39	0.083
SP[2]	2.2	1.2	0.34	2.8	1.4	0.20

[1] - for CO the peak is over 8 hours

[2] - Suspended Particles less than 10 microns:
units are Coefficient of Haze (COHs) per 1000 feet

TABLE 1

ONTARIO MOE DATA ON AIR QUALITY FROM MONITORING STATIONS NEAREST THE SHEPPARD-ALLEN INTERSECTION JUNE-DECEMBER 1988

	1 hour (ppm)	8 hour (ppm)	24 hour (ppm)	Annual Mean (ppm)
SO_2	0.25		0.10	0.02
CO	30.0	13.0		
O_3	0.080			
NO_2	0.20		0.10	
SP (COH)			1.0	0.5

TABLE 2

ONTARIO MINISTRY OF THE ENVIRONMENT AIR QUALITY CRITERIA

Receptor Location	**Maximum Carbon Monoxide (CO) Concentration**	**Maximum Nitrogen Dioxide (NO_2) Concentration**
	ppm (wind direction)	ppm ppm (wind) conversion 25% 10%
1	15.9 (250°)	0.20 0.14 (250°)
2	21.5 (240°)	0.23 0.15 (210°)
3	22.0 (240°)	0.23 0.15 (230°)
4	22.6 (240°)	0.23 0.15 (230°)
5	14.6 (190°)	0.15 0.12 (190°)
6	12.9 (230°)	0.13 0.11 (240°)
7	16.6 (260°)	0.23 0.15 (260°)
8	20.3 (260°)	0.18 0.13 (260°)
9	12.6 (280°)	0.10 0.10 (260°)
10	11.4 (300°)	0.10 0.10 (260°)
11	20.1 (330°)	0.20 0.14 (340°)
12	22.5 (260°)	0.25 0.16 (260°)
13	34.9 (270°)	0.38 0.21 (260°)
14	24.8 (230°)	0.25 0.16 (220°)
15	26.8 (150°)	0.25 0.16 (160°)
16	26.4 (10°)	0.28 0.17 (40°)
17	23.0 (0°)	0.25 0.16 (0°)
18	22.1 (90°)	0.25 0.16 (90°)
19	20.4 (120°)	0.20 0.14 (90°)
20	21.5 (160°)	0.25 0.16 (160°)
1-Hour MOE Criteria	30.0 ppm	0.20 ppm

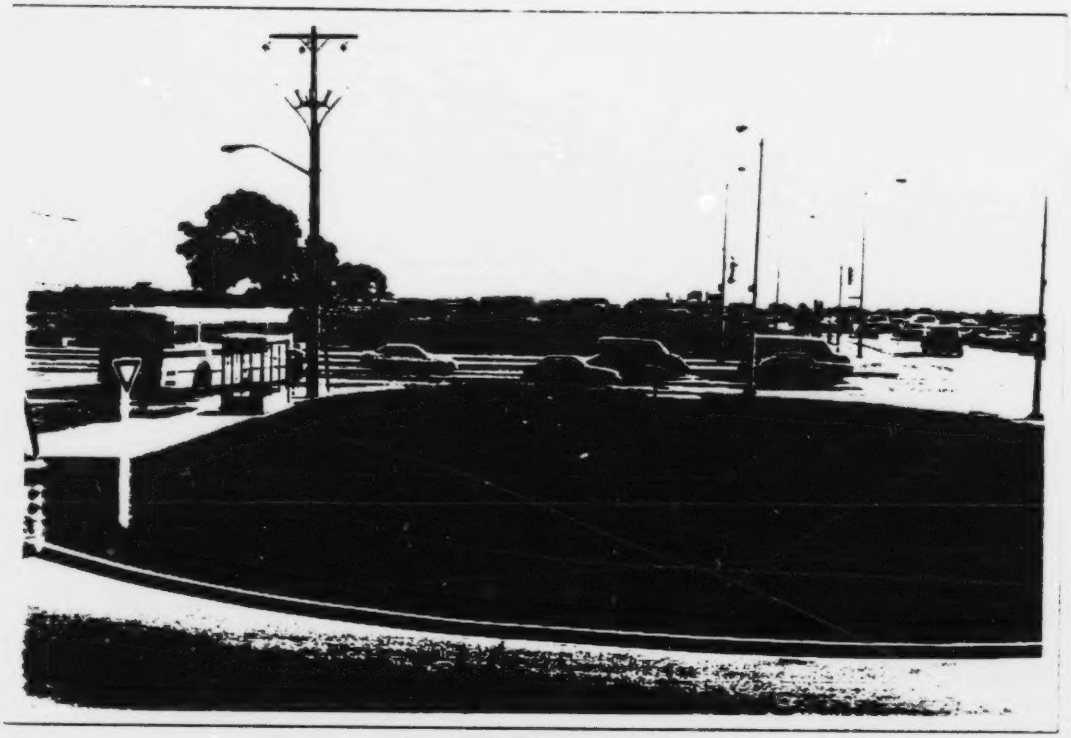
TABLE 3

PREDICTED AIR QUALITY - 1995 TRAFFIC WITH BUS TERMINAL

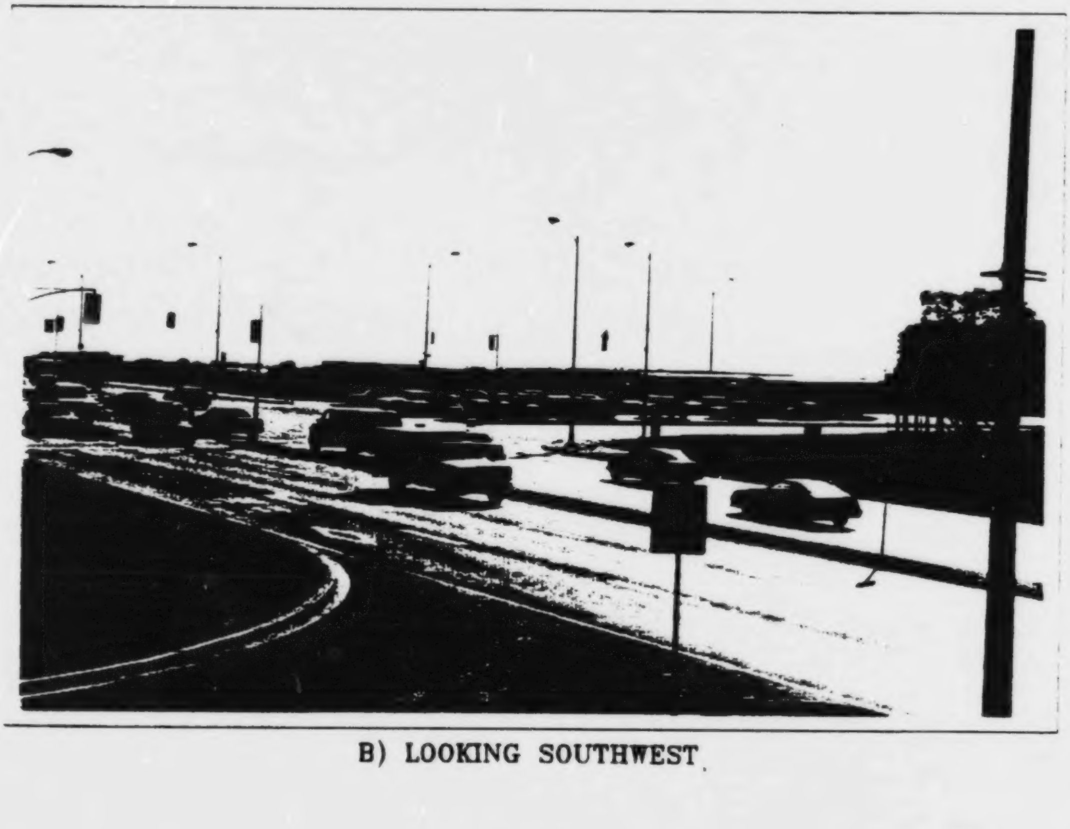
Receptor Location	Maximum Carbon Monoxide (CO) Concentration	Maximum Nitrogen Dioxide (NO_2) Concentration	
	ppm (wind direction)	ppm conversion 25%	ppm (wind) conversion 10%
1	15.8 (250°)	0.20	0.14 (250°)
2	21.5 (240°)	0.23	0.15 (210°)
3	21.9 (240°)	0.23	0.15 (230°)
4	22.6 (240°)	0.23	0.15 (230°)
5	14.6 (190°)	0.15	0.12 (190°)
6	12.9 (230°)	0.13	0.11 (240°)
7	16.3 (260°)	0.23	0.15 (260°)
8	19.2 (260°)	0.18	0.13 (260°)
9	10.8 (280°)	0.10	0.10 (260°)
10	10.6 (300°)	0.10	0.10 (260°)
11	20.1 (330°)	0.20	0.14 (340°)
12	22.2 (260°)	0.25	0.16 (260°)
13	34.7 (270°)	0.38	0.21 (260°)
14	24.8 (230°)	0.25	0.16 (220°)
15	26.7 (150°)	0.25	0.16 (160°)
16	26.4 (10°)	0.28	0.17 (40°)
17	23.0 (0°)	0.25	0.16 (0°)
18	21.8 (90°)	0.25	0.16 (90°)
19	20.1 (120°)	0.20	0.14 (90°)
20	21.4 (160°)	0.25	0.16 (160°)
1-Hour MOE Criteria	30.0 ppm	0.20 ppm	

TABLE 4

PREDICTED AIR QUALITY - 1995 TRAFFIC WITHOUT BUS TERMINAL

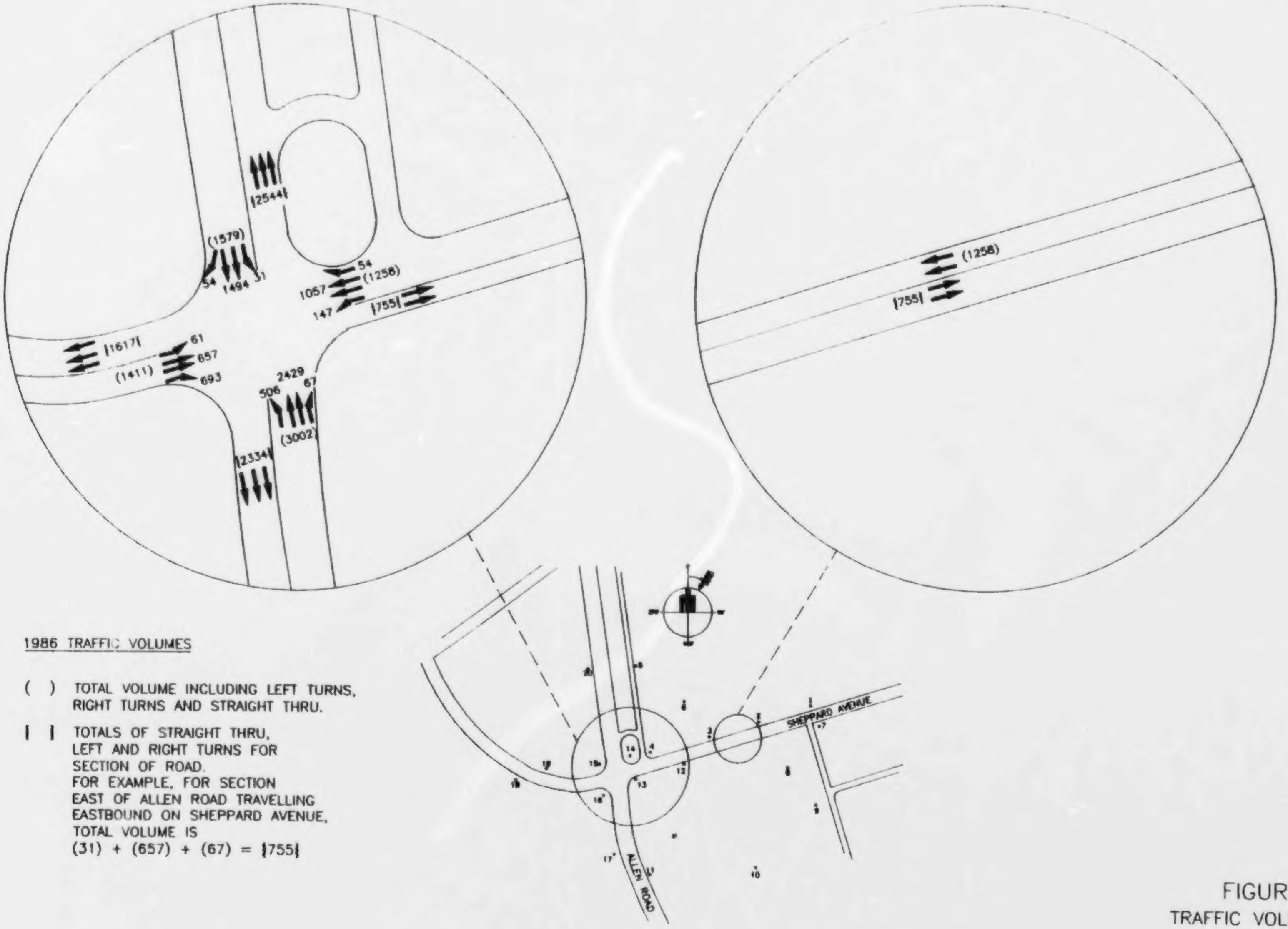


A) LOOKING SOUTH



B) LOOKING SOUTHWEST

FIGURE 1
SHEPPARD-ALLEN INTERSECTION


|2544|
(1579)
54
1494
31
54
(1258)
1057
147
|755|
|1617|
61
657
(1411)
693
2429
506
67
(3002)
|2334|
(1258)
|755|
SHEPPARD AVENUE
ALLEN ROAD

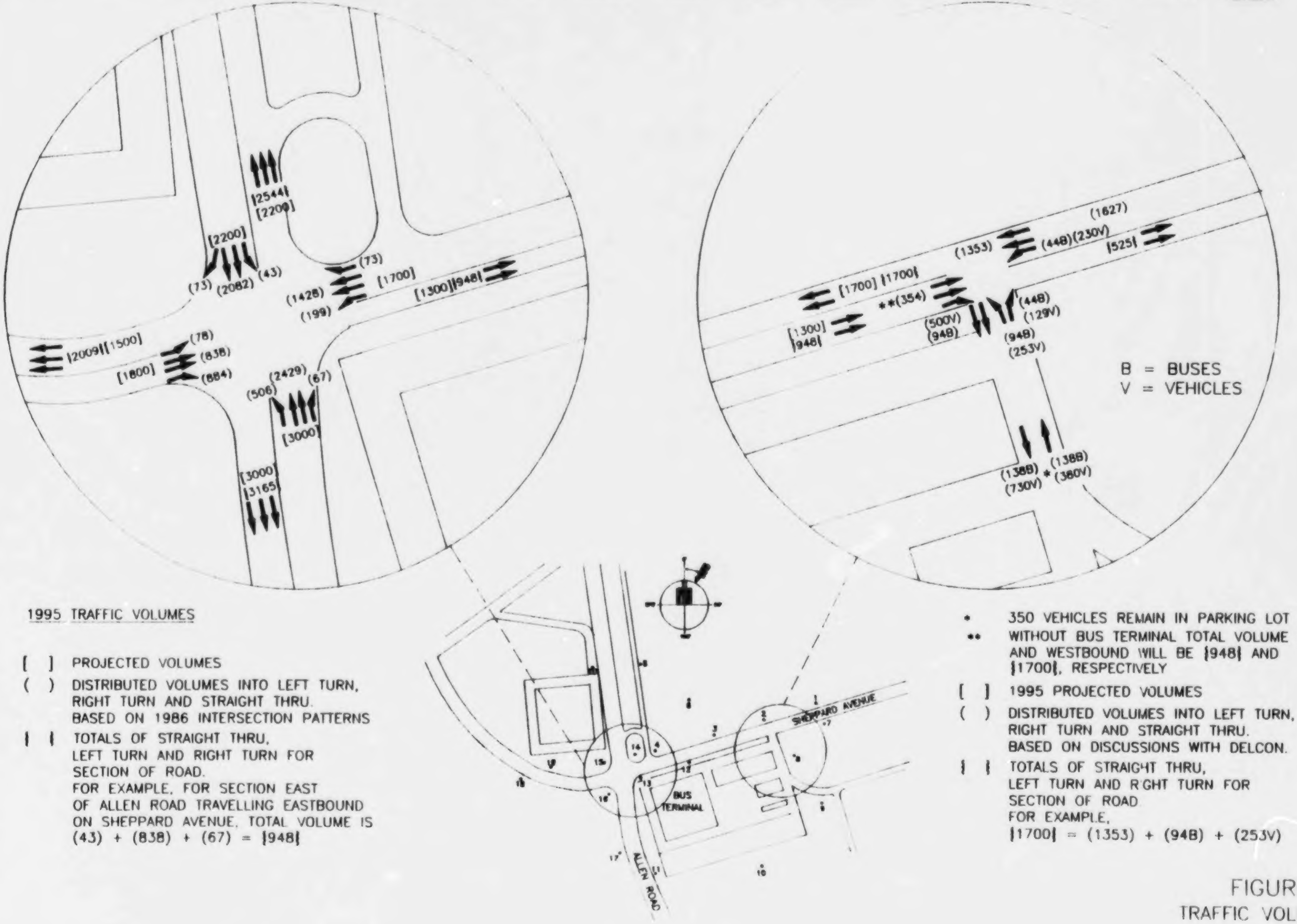
1986 TRAFFIC VOLUMES

( ) TOTAL VOLUME INCLUDING LEFT TURNS, RIGHT TURNS AND STRAIGHT THRU.

| | TOTALS OF STRAIGHT THRU, LEFT AND RIGHT TURNS FOR SECTION OF ROAD.
FOR EXAMPLE, FOR SECTION EAST OF ALLEN ROAD TRAVELLING EASTBOUND ON SHEPPARD AVENUE, TOTAL VOLUME IS
(31) + (657) + (67) = |755|

FIGURE 2
TRAFFIC VOLUMES FOR
1986

RWDI



[2200]
(73)
(2082)
(43)
|2544|
[2209]
(73)
(1428)
(199)
[1700]
[1300]|948|
|2009|[1500]
[1800]
(78)
(838)
(884)
(506)
(2429)
(67)
[3000]
[3000]
|3165|
(1627)
(1353)
(44B)(230V)
|525|
[1700] |1700|
**(354)
[1300]
|948|
(500V)
(94B)
(44B)
(129V)
(94B)
(253V)
(138B)
(730V)
*
(138B)
(380V)
B = BUSES
V = VEHICLES
SHEPPARD AVENUE
ALLEN ROAD
BUS TERMINAL

1995 TRAFFIC VOLUMES

[ ] PROJECTED VOLUMES

( ) DISTRIBUTED VOLUMES INTO LEFT TURN, RIGHT TURN AND STRAIGHT THRU. BASED ON 1986 INTERSECTION PATTERNS

| | TOTALS OF STRAIGHT THRU, LEFT TURN AND RIGHT TURN FOR SECTION OF ROAD.
FOR EXAMPLE, FOR SECTION EAST OF ALLEN ROAD TRAVELLING EASTBOUND ON SHEPPARD AVENUE, TOTAL VOLUME IS
(43) + (838) + (67) = |948|

* 350 VEHICLES REMAIN IN PARKING LOT

** WITHOUT BUS TERMINAL TOTAL VOLUME EASTBOUND AND WESTBOUND WILL BE |948| AND |1700|, RESPECTIVELY

[ ] 1995 PROJECTED VOLUMES

( ) DISTRIBUTED VOLUMES INTO LEFT TURN, RIGHT TURN AND STRAIGHT THRU. BASED ON DISCUSSIONS WITH DELCON.

| | TOTALS OF STRAIGHT THRU, LEFT TURN AND RIGHT TURN FOR SECTION OF ROAD
FOR EXAMPLE,
|1700| = (1353) + (94B) + (253V)

FIGURE 3
TRAFFIC VOLUMES FOR
1995

RWDI

APPENDIX 3.8

Bus and Traffic Noise Study Report

REPORT

NOISE IMPACT ASSESSMENT - ALLEN STATION

TECHNICAL REPORT #2

PROPOSED SPADINA SUBWAY EXTENSION

CITY OF NORTH YORK

PREPARED FOR

DELCAN

PREPARED BY

VALCOUSTICS CANADA LTD.

CONSULTING ENGINEERS

AUGUST 30, 1990

PROJECT: 89-145-01

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REPORT

NOISE ASSESSMENT - ALLEN STATION

TECHNICAL REPORT #2

PROPOSED SPADINA SUBWAY EXTENSION

CITY OF NORTH YORK

REGIONAL MUNICIPALITY OF YORK

1. INTRODUCTION

1.1 Purpose

Valcoustics Canada Ltd. was retained to prepare a noise impact assessment for each of the two proposed locations of the Allen Station. The analysis determines the potential noise impact of each station location and configuration on surrounding residential neighbours.

1.2 Site

The Allen Station is proposed to be located in one of two locations.

1) Southeast Corner of Allen Road and Sheppard Avenue.
2) Northwest Corner of Allen Road and Sheppard Avenue.

The northeast quadrant of the Allen Road/Sheppard Avenue intersection is predominantly residential. There is some commercial at the intersection. The area in the southeast quadrant is vacant land. However, there are residential uses to the east and southeast of this immediate area. The southwest quadrant is vacant land, which is part of Downsview Airport. In the northwest quadrant there is vacant land surrounded by commercial uses to the north and west.

The sound environment in this area is dominated by road traffic noise on Allen Road and Sheppard Avenue.

1.3 Receptors of Concern

There are groups of residences which have the potential to be impacted by the Allen Station operations. These groups are indicated in Figure 1. For purposes of the analysis, representative locations within each residential group were used. These locations are also shown on Figure 1.

The residences on Old Dufferin Street, to the east of Allen Road and north of Sheppard Avenue, are set back from both of these roadways. However, noise from road traffic on Allen Road is the dominant the sound source.

The residences located on the north side of Sheppard Avenue, east of Allen Road, receive high sound exposures due to their close proximity to the roadways.

There is no significant road traffic on Banting Avenue. However, for homes along Banting Avenue, distant road traffic noise from both Sheppard Avenue and Allen Road dominates the sound environment. For homes far away from Sheppard Avenue, Allen Road dominates the sound environment.

2. OPERATIONS

The Allen Station is proposed to be a multi-purpose facility. It will provide parking for commuters, a Kiss n' Ride facility, a bus concourse facility, as well as access to the Spadina Subway Line which will be extended to Sheppard Avenue.

Up to approximately 1,000 parking spaces will be provided for users of the TTC system. The majority of cars would typically be expected to arrive at the parking lot over a short duration in the morning and leave over a short duration in the evening. At the southeast corner station, surface parking would be provided. The northwest station would provide predominantly underground parking.

The Kiss 'n Ride facility will have 20 parking slots, but will be capable of handling approximately 40 to 45 cars at any time.

Buses will use the bus concourse to drop-off and pick-up passengers. Buses will travel around the concourse, essentially in a circular path. At the southeast corner station, all buses will enter and leave through the same entrance on Sheppard Avenue. For the northeast corner station there would be two bus entrances to the concourse, one from southbound Allen Road, and one from Kodiak Crescent, connecting to Sheppard Avenue.

3. GUIDELINES FOR NOISE IMPACT ASSESSMENT

The main criterion for assessment of noise impact in this case is the potential change to the ambient sound environment at the receptors of concern, due to implementing the proposed undertaking. As is discussed below, the existing ambient sound environment in the area around the proposed sites is dominated by existing road traffic. The receptors of concern are the existing residential uses in the neighbourhood of the sites.

Sound levels in the community change from instant to instant as a function of local and distant traffic and local activity. For this reason, some form of statistical descriptor of the sound environment is needed. In Ontario (and in other jurisdictions) the predominant descriptor used for noise impact assessment is L_{eq}, the energy equivalent continuous sound level. This is the constant sound level that would result in the same total sound energy exposure over the specified time, as would the actually varying sound levels. For purposes of this study, a one-hour time period has been used.

Changes in sound exposures of 3 dBA or less are considered insignificant and in this context would not be perceived by most people. Changes of 4 to 5 dBA are considered marginally significant in that they are "just noticeable". Increases of 10 dBA or more are increasingly significant, in that a 10 dBA change in sound level corresponds to a change in perceived loudness by about a factor of two.

4. AMBIENT SOUND ENVIRONMENT – 1994

Future background traffic data for the 1994 a.m. peak hour for both Sheppard Avenue and Allen Road was obtained from DeLCan. See Table 1.

Using this data, the ambient sound levels at the receptors of concern were determined using ORNAMENT - STAMSON V3.0, the computerized noise prediction model of the Ministry of the Environment.

Ambient sound level measurements were performed at various locations, which were mainly to the south of Sheppard Ave. These measurements are summarized in Technical Report #1. A brief sound level measurement was performed at the northeast corner of the Allen Road/Sheppard Avenue intersection. At this location, a one-hour L_{eq} ranging from 56 to 58 dBA was measured.

The intersection of Allen Road and Sheppard Avenue is located very close to most of the receptors of concern. During the a.m. peak hour, congestion in all directions will occur. For purposes of the analysis, it was assumed that, on average, vehicles very close to the intersection would travel at one-half of the posted speed limit, while vehicles in the near vicinity of the intersection would be travelling at two-thirds of the posted speed limit. It was assumed that 2.5% of the total traffic volume was heavy trucks and 2.5% was a combination of medium trucks and buses.

Screening from the earth berm between Allen Road and Old Dufferin Street and intervening buildings was accounted for in the analysis.

A summary of the results is shown in Table 2.

Based on the ambient sound level measurements summarized in Technical Report #1, it is expected that sound levels due to Allen Road will not vary significantly throughout the day.

5. NOISE ANALYSIS

The station operations include a number of different operations each occurring simultaneously. The operations were broken down into different components and modelled separately.

1) The bus concourse operations.
2) The Kiss 'n Ride facility.
3) Cars driving into the parking lot.
4) Increased bus traffic on Sheppard Avenue.
5) Potential roof-top mechanical equipment.

Each station location alternative was analyzed separately.

The analysis is based on the a.m. peak hour bus and car traffic data provided by DeLCan. Sound level emission values for various bus operations were provided by TTC, as shown in Table 3.

5.1 Southeast Station

All segments of the operations are located in the southeast quadrant of the Allen Road/Sheppard Avenue intersection. See Figure 2 for a site plan. Table 4 summarizes the sound exposure levels at the receptors of concern, due to each operation.

5.1.1 Bus Concourse

Buses driving into the bus concourse to both drop-off and pick-up passengers will have three separate operating modes.

1) Driving at a more or less constant speed while entering or leaving.
2) Idling while either dropping-off or picking-up passengers.
3) Accelerating as they leave the bus concourse area.

The maximum sound emission levels shown in Table 3, measured at the furthest distance from the bus, for each operating mode above, were used in the analysis.

A new signalized intersection is proposed on Sheppard Avenue, just to the east of Allen Road. Buses would enter the Allen Station via this intersection. See Figure 2. The path from the entrance to the bus concourse is short. Generally, passengers are dropped-off on one side of the concourse and picked-up on the other. On departure, the buses continue around the concourse to the intersection to depart onto Sheppard Avenue.

For the analysis, the buses approaching the concourse have been modelled as moving point sources travelling along a straight line path. This technique is summarized in Appendix A. Buses driving around the concourse, have been modelled as point sources travelling on a circular path. See Appendix B for a summary of this analysis technique.

Using the modelling technique outlined above and the assumptions listed below, the sound exposure levels at surrounding neighbours, due to the bus concourse activities were determined.

1) A total of 96 buses per hour use the concourse.
2) Each bus idles for a total of 5 minutes with a sound emission level of 68 dBA @ 15 m (based on 74 dBA @ 7.5 m), while in the concourse.
3) Each bus accelerates at full throttle for 10 seconds, with a sound emission level of 78 dBA @ 15 m, while in the concourse.
4) The approach to and departure from the concourse each take 15 seconds, with each bus producing 78 dBA @ 15 m.
5) The bus terminal structure will screen a bus for any given receptor for about half the time.

5.1.2 Kiss 'n Ride

At the Kiss 'n Ride facility, cars arrive, drop-off or pick-up passengers and leave. As can be seen from Figure 2, these cars would essentially travel in a circular path. Thus, this source was modelled as a point source moving in a circular path as discussed in Section 5.1.1. The analysis assumes that 380 cars will travel through the Kiss 'n Ride area per hour. A total of 20 parking spaces are supplied for the Kiss n' Ride area. However, it is expected that 40 to 45 cars would be in the area during peak times. Thus, the analysis, was based on 45 cars being present at anytime, each for a total of about 7-8 minutes on average.

The sound emission level for each car was extrapolated from data provided in reference 2. For purposes of the noise analysis, it was assumed that the average speed through the facility is 20 km/hr.

5.1.3 Parking Lot

Cars will travel south along the eastern perimeter of the site to the parking lot, at an assumed speed of 20 km/hr. This analysis addresses the cars moving along the driveway to the parking lot and assumes that potential noise impact due to movements within the parking lot would be negligible, due to slower speeds.

The analysis was done using STAMSON V3.0 - ORNAMENT, the computerized noise prediction model of the Ministry of the Environment with manual adjustments, since this model requires a minimum speed of 40 km/hr. The analysis is based on 350 cars entering the parking lot each hour at the peak period.

5.1.4 Road Traffic

As a result of the development of the Allen Station, there will be an increase in the bus traffic on Sheppard Avenue. In addition to this, there will be a new signalized intersection, which will potentially impact upon the residences on the north side of Sheppard Avenue. See Figures 1 and 2.

There are two components to the analysis:

1) Buses travelling along Sheppard Avenue from either direction, towards the intersection.
2) Buses accelerating at the intersection into and out of Allen Station.

A different bus volume approaches the intersection from the west than does from the east. Thus, for the buses travelling along Sheppard Avenue, two separate segments were considered, one on each side of the intersection. It was assumed that in these segments buses would travel at a constant speed. The bus turning movements into the station are shown on Figure 3. There is a total of 96 buses that will be entering the station over the a.m. peak hour; 69 from the west and 27 from the east. This is one-way traffic. These buses will leave the station and travel in the direction from which they originated. The background bus traffic that would be expected to exist in 1994 with no station is 16, travelling each direction on Sheppard Avenue. Thus, the additional one-way bus traffic due to the station, is 53 from the west and 11 from the east.

In addition to the bus traffic, there is also car traffic associated with the Kiss n' Ride and parking facilities. For purposes of the analysis, all car traffic (380 to Kiss n' Ride and 350 to parking lot) has been assumed to be additional traffic (i.e. not accounted for in the traffic in Table 1). It was also assumed that there is an even split on the directional approach of these cars arriving at the intersection.

Using ORNAMENT - STAMSON V3.0 and the additional bus and car traffic, the sound exposures for each segment were calculated at the receptor locations.

In addition to the buses and cars travelling on Sheppard Avenue, there will also be turning movements at the intersection in front of the station. During a one hour period, a total of 182 buses will travel through the intersection; 96 entering and 96 leaving. It has been assumed that at any moment, half would be accelerating and the other half would be travelling at constant speed. Thus, a total of 96 buses were assumed to be accelerating within the intersection each hour. The acceleration for each bus was taken to last for 5 seconds. It was assumed that one bus accelerating would produce 78 dBA @ 15 m. Due to the low emission level of cars compared to buses, the cars accelerating in the intersection have been assumed to be insignificant.

5.1.5 Mechanical Equipment

It is anticipated that some form of mechanical equipment will be required to provide ventilation. At this time no details are available regarding the type of equipment that would be used. If roof-top mechanical equipment of some kind is used, sound levels can easily be mitigated by proper engineering design, silencing or enclosures. Thus, this aspect is not considered further.

5.2 Northwest Station

All components of this alternative are located in the northwest quadrant of the intersection. However, the only components on the surface are the bus concourse and Kiss n' Ride facility. The parking facilities would be predominantly located underground, with a few surface parking spaces. A site plan for this location is shown as Figure 4. There is also the potential that an office building will be located on the site, adjacent to Allen Road.

The operation of this station was broken down into three components.

1) The bus concourse operations.
2) The Kiss n' Ride facility.
3) Potential roof-top mechanical equipment.

Table 5 summarizes the sound exposures due to the operations.

5.2.1 Bus Concourse

Buses travelling south on Allen Road will enter the bus concourse directly, via an entrance from Allen Road. All other buses will enter and leave using Kodiak Crescent. Figure 5 summarizes the turning movements at this station.

The concourse will function the same way as was discussed in Section 5.1.1. Again, the operations can be modelled as moving point sources travelling along a straight path for buses entering from Kodiak Crescent and as moving point sources travelling a circular path for the concourse activities, including time for idling, etc. as described earlier.

5.2.2 Kiss 'n Ride

The Kiss n' Ride facility will be located close to Sheppard Avenue. It will handle a maximum of approximately 380 cars per hour, similar to the facility discussed in Section 5.1.2.

Again, this component was modelled as moving point sources travelling in a circular path.

5.2.3 Mechanical Equipment

Any mechanical equipment required for ventilation can be easily mitigated as discussed in Section 5.1.5.

6. NOISE IMPACT ASSESSMENT

In order to assess the impact of each station location, the predicted sound exposures due to the operations must be compared to the ambient or background sound levels that would be expected to exist in the year 1994, without the presence of the station. Of particular concern are the magnitude of the changes above this ambient.

6.1 Allen Station - Southeast Corner

As can be seen from Table 4, the sound exposure due to traffic on Sheppard Avenue is the dominant source at Receptors 1 to 3. The signalized intersection was of greater significance for those receptors close to the intersection (Receptors 2 & 3), than for those farther away.

At Receptor 4, the bus concourse activity is the most significant.

At Receptor 5, the turning movements and new traffic on Sheppard Avenue are not significant. Thus, because of proximity, the bus concourse activity is the most significant component.

At Receptor 7, the bus concourse activity is the most significant because of proximity. Sheppard Avenue traffic is the next largest componenet, although the effects of turning movements are less than at Receptor 2.

The largest change in sound exposure due to the station, at any receptor is 4 dBA. This is considered to be a minor excess over the ambient that would otherwise exist. In fact, this excess would likely not be noticeable, to most people, all other factors being equal. The majority of changes would be in the range of 0 to 3 dB, which is considered insignificant.

6.2 Allen Station – Northwest Corner

This alternative would have two benefits.

1) It will decrease additional bus traffic on Sheppard Avenue.

2) Move bus concourse activities to a less sensitive area.

The result of this will be insignificant sound exposures at Receptors 1 to 4. This station will be located closer to some of the residences along Old Dufferin Street. However, most of these will be well screened by the existing berm between Old Dufferin Street and the Allen Road.

Table 5 summarizes the impact of the station on the nearest residential neighbours. As can be seen from the table, the ambient sound levels are higher than any sound levels the station activities might produce at the Receptors, and the net total increment would be one decibel, which is insignificant.

The commercial uses close to the proposed location at the northwest quadrant are not as sensitive to increases in noise levels. For the most part, windows and doors would be closed and air conditioning would provided. It is likely that any increase expected would not be noticeable.

7. CONCLUSIONS

The northwest station is inherently at a more appropriate location by virtue of the fact that it is a less sensitive area with respect to noise and the immediate neighbours of concern. Its noise impact would be insignificant. The southeast station would produce a slightly higher change to the ambient sound exposures (up to 4 dBA). This range of change would generally be considered insignificant up to 3 dBA, with 4 dBA considered a minor impact.

The northwest corner alternative is the preferred option.

RESPECTFULLY SUBMITTED,

VALCOUSTICS CANADA LTD.

Per:
David L. Parkinson, B.A.Sc., P.Eng.

D.L. PARKINSON

Per:
A.D. Lightstone, Ph.D., P.Eng.

A.D. Lightstone

DLP/ADL/lr
89-145.TCH/Reports/WP50
Reps-8

REFERENCES

1. "Model Municipal Noise Control By-Law", Final Report, prepared by the Ministry of the Environment, August 1978.

2. "Noise Emission Levels for Vehicles in Ontario", document HOS-85-02, prepared by Ministry of Transportation, dated November, 1985.

TABLE 1

1994 ROAD TRAFFIC DATA

Road	A.M. Peak Hour Volume	Speed (km/hr)	% Commercial Vehicles[1]
Sheppard (East of Allen)		60	5
EB	1300		
WB	1700		
Allen (North of Sheppard)		70	5
NB	2200		
SB	2200		
Allen (South of Sheppard)		70	5
NB	3000		
SB	3000		

---

(1) The 1994 background bus traffic is assumed to be contained within this percentage.

TABLE 2

FUTURE (1994) AMBIENT SOUND LEVELS[1]

Receptor	Source	One-Hour L_{EQ} (dBA)	Combined
1	Sheppard Avenue Allen Road	69.0 52.9	69.1
2	Sheppard Avenue Allen Road	69.0 50.0	69.1
3	Sheppard Avenue Allen Road	69.0 49.0	69.1
4	Sheppard Avenue Allen Road	54.6 50.6	56.1
5	Sheppard Avenue Allen Road	58.7 59.3	62.0
6	Allen Road	57.8	-
7	Sheppard Avenue Allen Road	63.7 57.1	64.6

(1) Sound levels shown are based on 1994 road traffic data and assume that the Allen Station is not present.

TABLE 3

BUS SOUND LEVELS

YORK UNIVERSITY SITE[1]

Overall Sound Levels - dBA

Test Conditions	**Flyer #63031**	**G.M. Classic #6219**
Engine Idling[2] 1.5 m	81	82
Engine Idling[2] 7.5 m	69	74
50 km/hr Passby 7.5 m	85	82
50 km/hr Passby 15 m	78	74
Full Throttle Passby[3] 7.5 m	86	83
Full Throttle Passby[3] 15 m	78	75

(1) Data supplied by TTC.
(2) Vehicle Stationary; Microphone behind rear of bus.
(3) Full Throttle to the 1st gear change.

TABLE 4

SOUND EXPOSURES – SOUTHEAST STATION

		SOUND EXPOSURES (dBA)							
Receptor	**Distance (m)(1)**	**A(2) Traffic On Sheppard**	**B Kiss 'n Ride**	**C Cars Into Parking Lot**	**D Bus Concourse**	**E(3) Station Combined**	**F Ambient (dBA)**	**G(4) Total (dBA)**	**H(5) Change (dBA)**
1	19	62	52	33	64	66	69	71	2
2	19	67	52	31	62	69	69	72	3
3	19	63	51	36	59	65	69	71	2
4	85	51	52	36	56	58	56	60	4
5	76	54	47	24	57	59	62	64	2
7	19	58	51	34	63	64	65	67	2

(1) Distance is from the centreline of Sheppard to the building face closest to Sheppard.

(2) Due to buses and cars attributable to station, including turning movements.

(3) Combined effect of columns A to D inclusive.

(4) Combined effect of station sound energy plus ambient.

(5) Expected change to ambient.

TABLE 5

SOUND EXPOSURES – NORTHWEST STATION

Receptor	Distance (m)	SOUND EXPOSURES (dBA) A[3] Buses on Sheppard	B Kiss n' Ride	C Bus Concourse	D[4] Combined	E Ambient (dBA)	F[5] Total (dBA)	G[6] Change (dBA)
5	76[1]	47	40	47	51	62	62	0
6	68[2]	-	41	51	51	58	59	1
7	19[1]	52	46	51	55	65	65	0

(1) Distance shown is to the centreline of Sheppard Avenue.

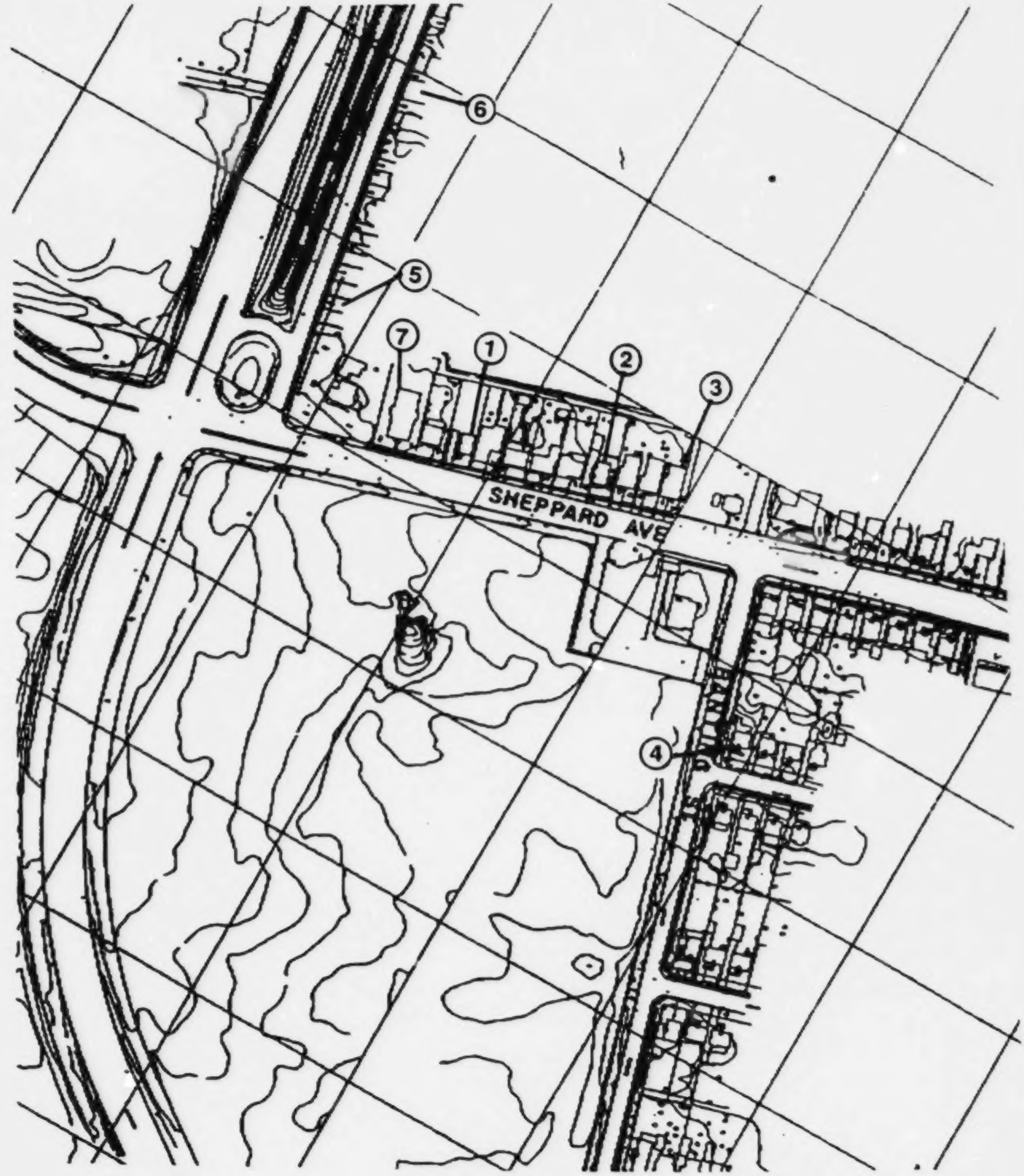
(2) Distance shown is to the centreline of Allen Road.

(3) Additional buses attributable to station.

(4) Combined effect of columns A to C inclusive.

(5) Combined effect of station sound energy plus ambient.

(6) Expected change to ambient.


6
5
7
1
2
3
4
SHEPPARD AVE

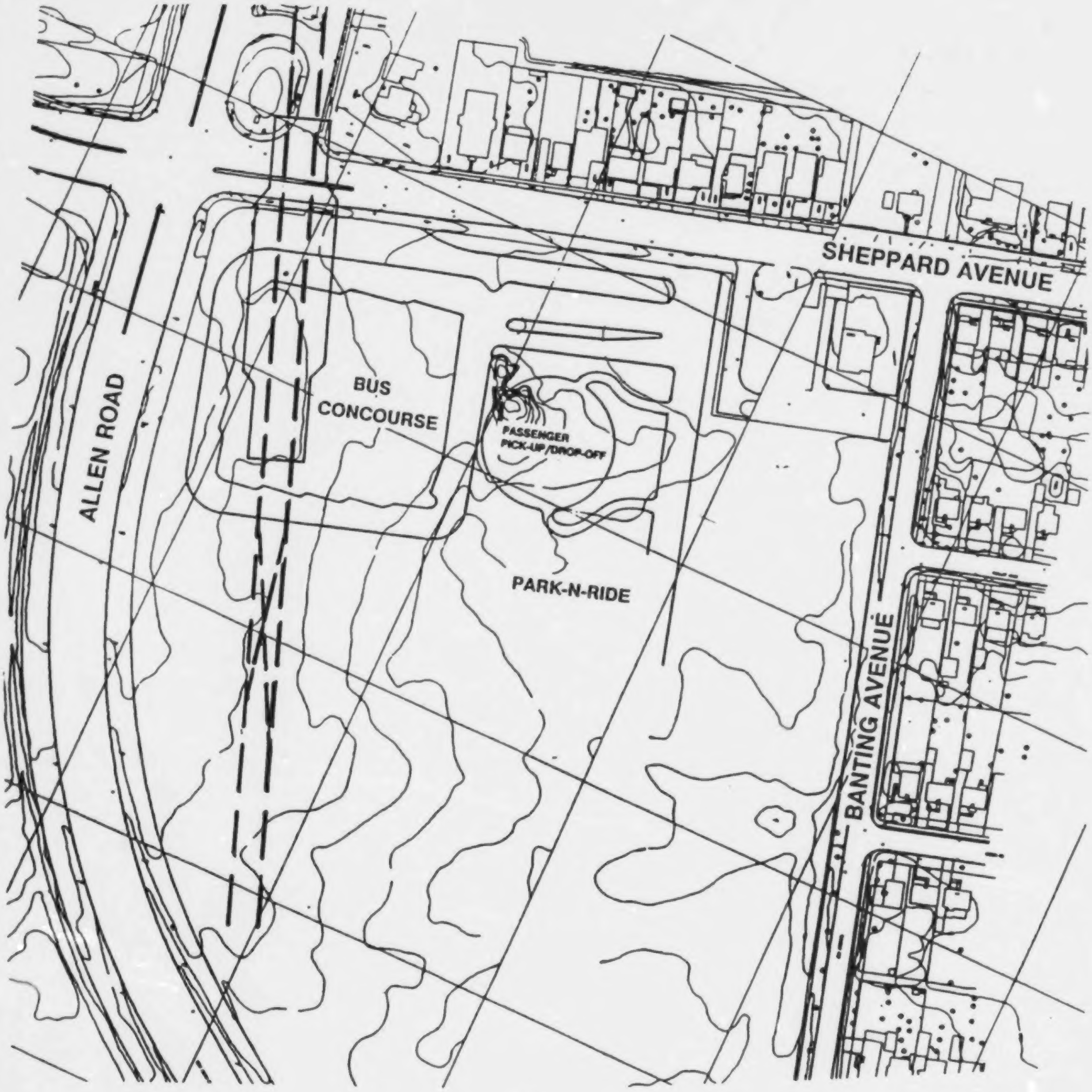
Spadina Subway Extension
Allen Station

Key Plan and Receptors of Concern

Date: June 25, 1990

File: 89-145-01

Figure 1


SHEPPARD AVENUE
ALLEN ROAD
BUS CONCOURSE
PASSENGER PICK-UP/DROP-OFF
PARK-N-RIDE
BANTING AVENUE

Spadina Subway Extension
Allen Station

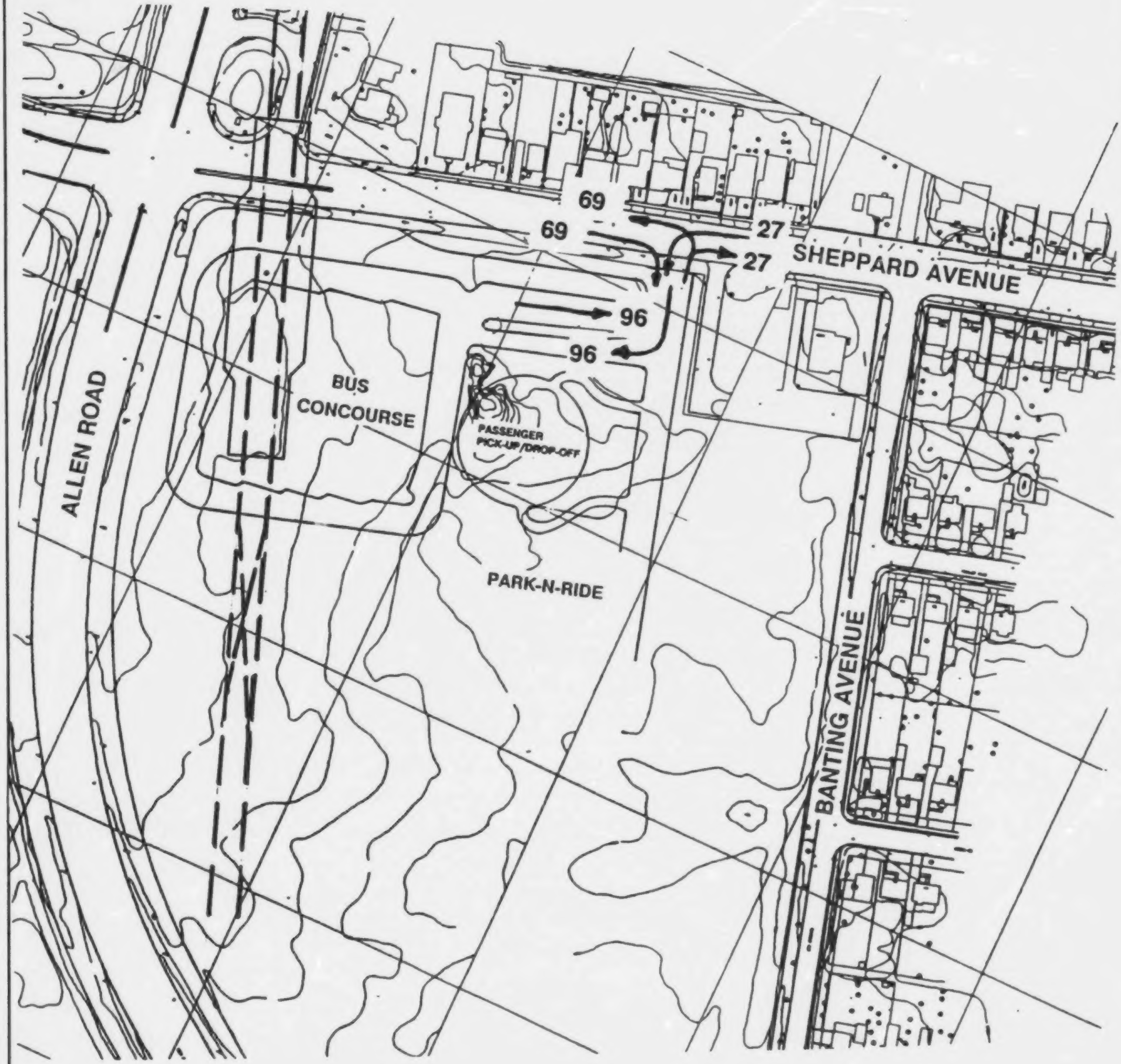
Site Plan - Southeast Station

Date: June 25, 1990

File: 89-145-01

Figure 2

VALCOUSTICS
Canada Ltd.


69
69
27
27
SHEPPARD AVENUE
96
96
ALLEN ROAD
BUS
CONCOURSE
PASSENGER
PICK-UP/DROP-OFF
PARK-N-RIDE
BANTING AVENUE

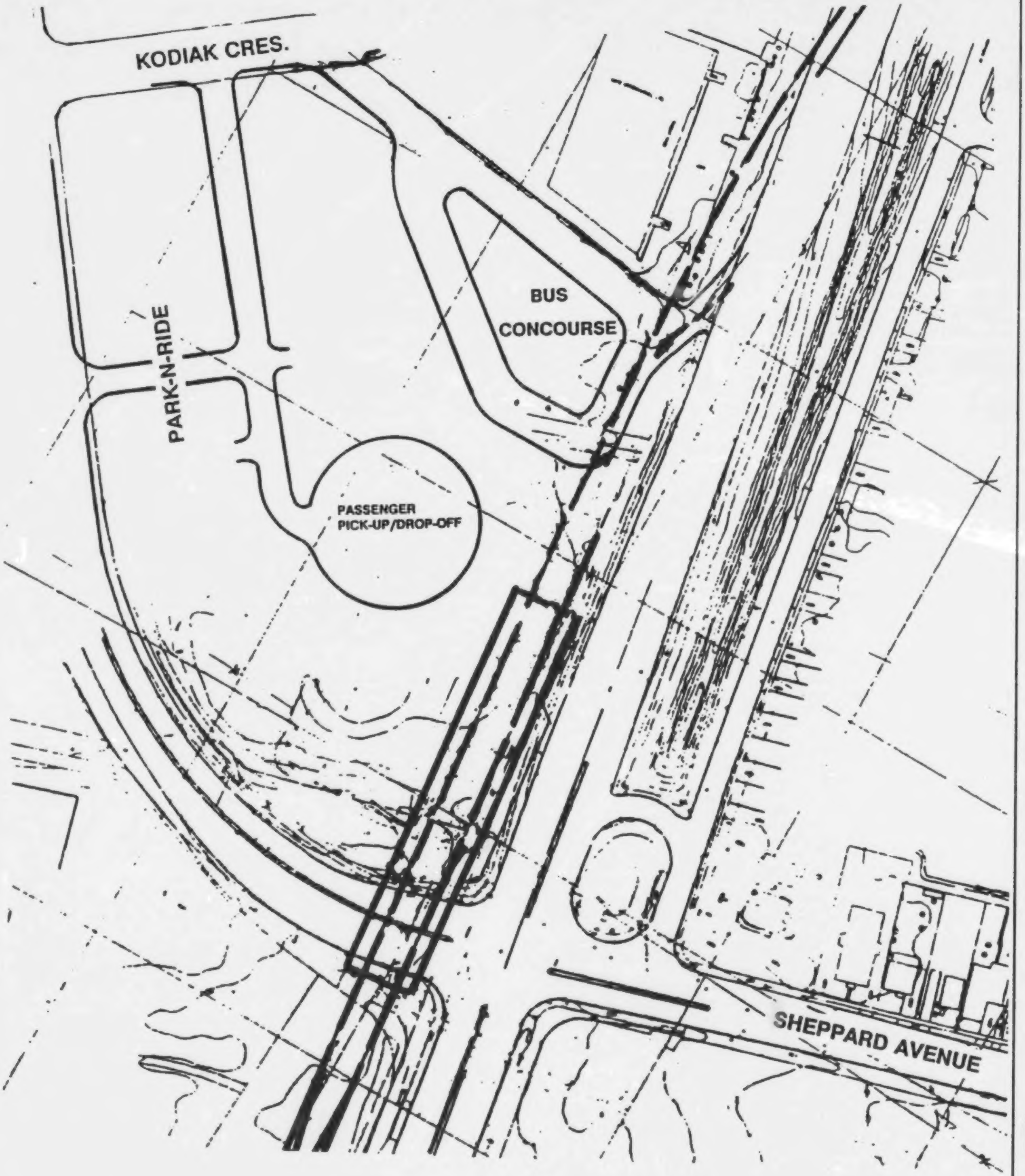
Spadina Subway Extension
Allen Station

Date: June 25, 1990
File: 89-145-01

Bus Turning Movements
Southeast Station

Figure 3

VALCOUSTICS Canada Ltd.


KODIAK CRES.
BUS CONCOURSE
PARK-N-RIDE
PASSENGER PICK-UP/DROP-OFF
SHEPPARD AVENUE

**Spadina Subway Extension
Allen Station**

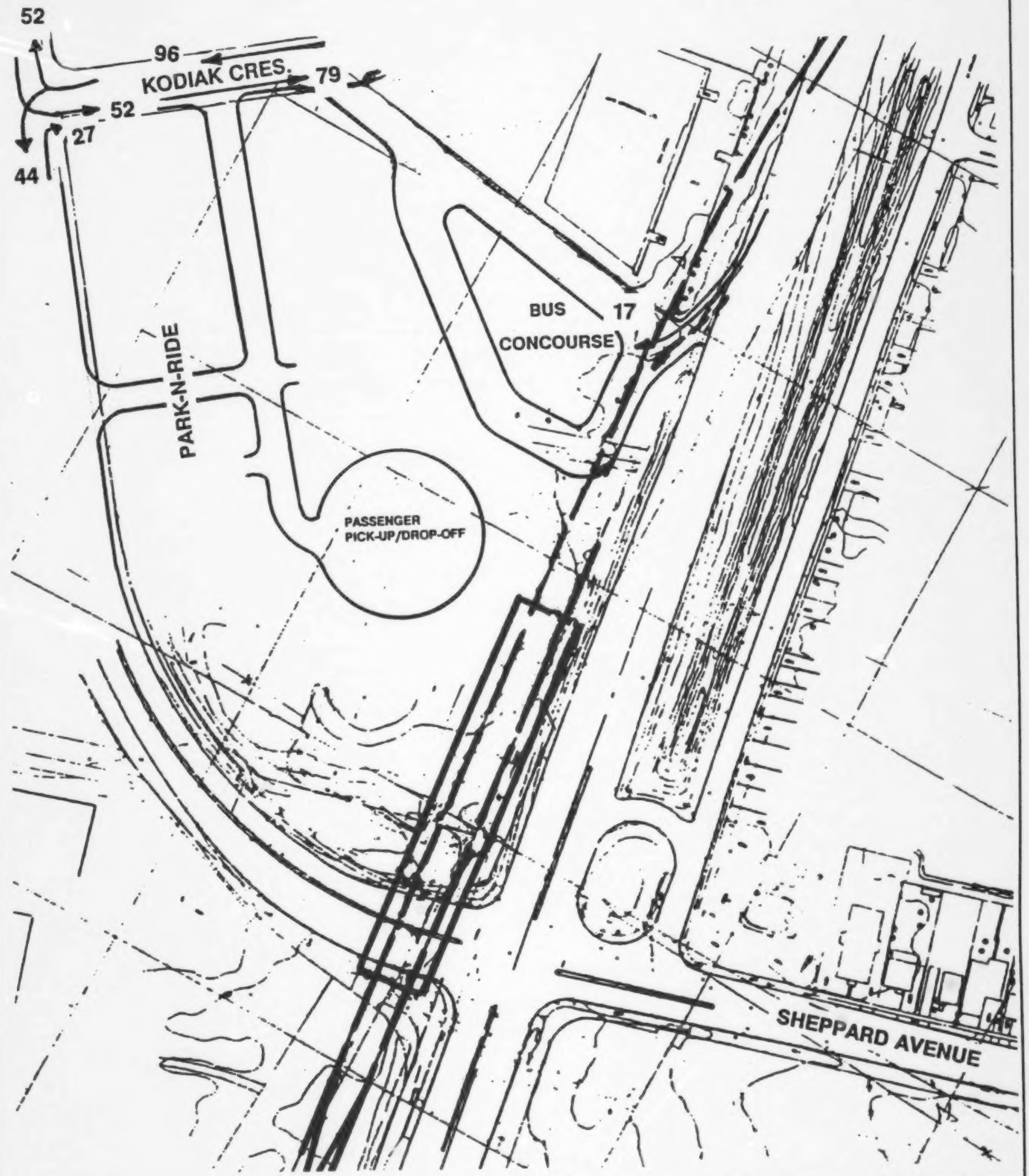
Date: June 25, 1990

File: 89-145-01

Site Plan – Northwest Station

Figure 4

VALCOUSTICS
Canada Ltd.


52
96
KODIAK CRES.
79
52
27
44
BUS
17
CONCOURSE
PARK-N-RIDE
PASSENGER
PICK-UP/DROP-OFF
SHEPPARD AVENUE

Spadina Subway Extension
Allen Station

Date: June 25, 1990 File: 89-145-01

Bus Turning Movements
Northwest Station

Figure 5

APPENDIX A

MOVING POINT SOURCE MODEL – STRAIGHT LINE PATH

APPENDIX A

ANALYSIS FOR THE MODELLING OF A MOVING POINT SOURCE ALONG A STRAIGHT LINE PATH

Type 1*

$$L_{eq} = L_o + 10 \log \left[\frac{X_o}{Y} \left[\tan^{-1} \frac{Y_b}{X_o} - \tan^{-1} \frac{Y_a}{X_o} \right] \right]$$

Where L_{go} = SPL at X_o
$Y = Y_b - Y_a$

Type 2*

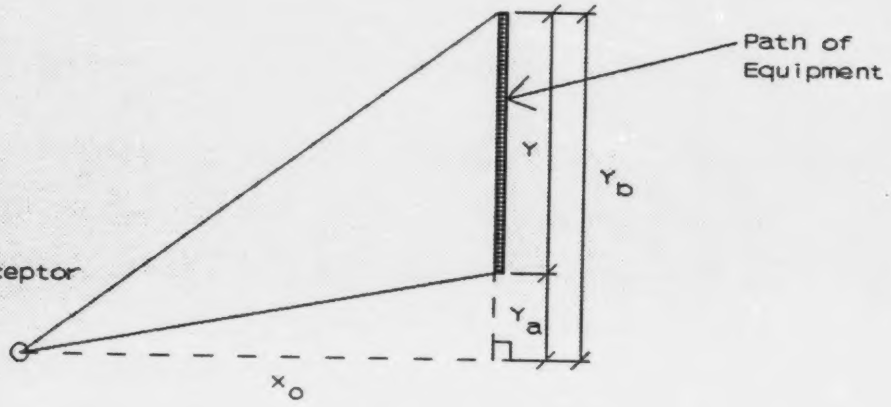
$$L_{eq} = L_o + 10 \log \left[\frac{X_o}{Y} \left[\tan^{-1} \frac{Y_b}{X_o} - \tan^{-1} \frac{Y_a}{X_o} \right] \right]$$

Where L_{eq} = SPL at x_o
$Y = Y_a + Y_b$

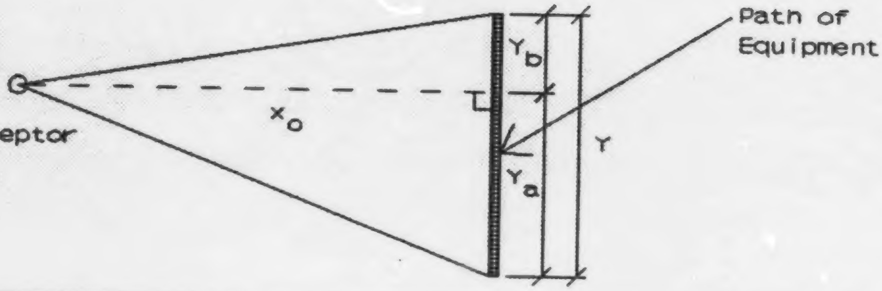
Note: Angles are in radians.

* See Figures on the following page.

Type 1


Path of Equipment
Y
Y_b
Receptor
Y_a
x_o

Type 2

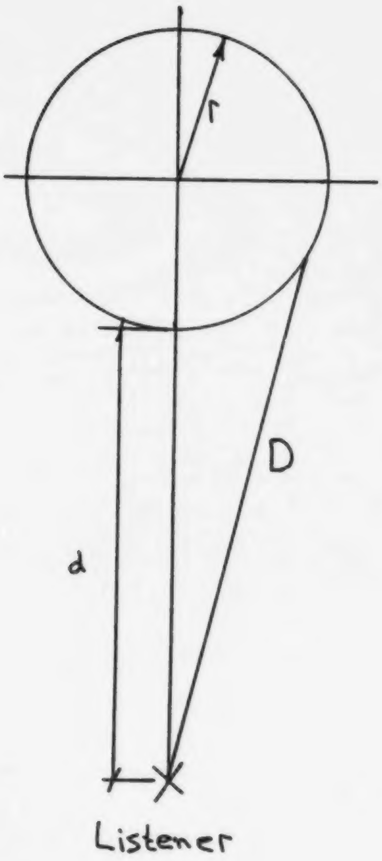

Path of Equipment
Y_b
x_o
Receptor
Y
Y_a

APPENDIX B

MOVING POINT SOURCE MODEL – CIRCULAR PATH

APPENDIX B

ANALYSIS FOR THE MODELLING OF A MOVING POINT SOURCE ALONG A CIRCULAR PATH



D -distance from listener to any point on track
d -distance of closest approach.

Track effect is the ratio of: energy of source sitting at point of closest approach to that with source travelling around track.

$$\text{Track effect in decibels} = 10 \log \left[\frac{d}{2r + d} \right]$$

APPENDIX 3.9

Subway Noise and Vibration Study Report

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ASSESSMENT OF NOISE AND VIBRATION IMPACT
FOR
THE SPADINA SUBWAY EXTENSION PROJECT

9 MARCH 1990

Prepared For:

DELCAN CORPORATION
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CANADA

By:

Harjodh S. Gill, Ph.D.
Principal

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1.0 INTRODUCTION

This report presents the noise and vibration design criteria applicable to the operation of subway transit vehicles, assessment of noise and vibration impact from construction activities, and an evaluation of the potential ground-borne noise and vibration and airborne noise impact due to transit train passbys along each alternative alignmnent for the Spadina Subway Extension Project.

Section 2 presents noise and vibration design criteria. These criteria are similar to those that have been applied to previous transit projects and previous extensions of the TTC subway system.

Sections 3 and 4 present estimates of wayside airborne noise and ground-borne noise and vibration expected along the alignment from the subway train operations, and identify community areas and individual structures along the alignment that may require mitigation measures to assure acceptable noise and vibration levels.

Section 5 presents an assessment of noise and vibration impact from construction activities.

2.0 NOISE AND VIBRATION CRITERIA

2.1 General

The basic goals of noise and vibration criteria as they apply to a new rail transit line are to: (1) minimize the adverse impact of system operations and construction on the community by controlling transmission of noise and vibration to adjacent properties, and (2) provide noise and vibration control consistent with economic constraints and appropriate technology.

A wayside community noise and vibration impact criteria provide a basis from which to assess impact and to determine the type and extend of noise and vibration reduction measures necessary to avoid annoyance in the general community and minimize interference with any particularly sensitive nearby activity. The type of land use or occupancy and existing ambient noise and vibration are factors that are used to determine the appropriate criteria. Obviously, a noise of a given magnitude is more objectionable in a quiet residential area at night than in a busy commercial area during the night.

For the Spadina Subway Extension Project, the adjacent land use is a primarily residential with some commercial and industrial properties in some areas.

Typical existing ambient or background noise and vibration levels vary significantly from one type of community to the next. Therefore, the nature of the community in which the transit system is to be located must be determined or defined before the criterion for permissible noise or vibration levels from the transit system is determined for each section of track or each community area.

Table 2.1 indicates the five generalized definitions of wayside areas used to categorize communities along transit corridors for the purpose of assigning appropriate noise and vibration criteria. The table indicates the description of the usage or occupancy and the normally expected range of ambient noise levels. These categories and noise levels are based on information developed from several studies of rail transit corridor environments along with data presented in the 1974 U.S. Environmental Protection Agency (EPA) document, "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, " usually referred to as the "Levels Document" (Ref. 1) and other field data obtained in many community areas in the U.S.A. and Canada.

The categories defined in Table 2.1 are appropriate for use in defining applicable noise and vibration design criteria for the Spadina Subway Extension Project. The land use or area categories are similar to those used for similar purposes at other transit systems and are also noted in the APTA Publication, "Guidelines for Design of Rapid Transit Facilities" (Ref. 2). In most cases, experience with the new systems now in operation and extensions of older systems has indicated that these categories and the associated criteria provide for adequate results with most of the neighbors of the new transit facility finding the noise and vibration acceptable.

In areas where the transit line is in subway, both ground-borne noise and ground-borne vibration might be perceptible. Ground-borne noise is a rumbling noise perceived inside a building which is due to the radiation of noise from the vibrating floor and sometimes walls during a train passby. For at-grade operations, airborne noise will usually mask ground-borne noise.

2.2 Wayside Airborne Noise Criteria

There are two basic types of noise criteria, the first is based on an allowable maximum passby noise level and the second on some type of noise exposure limit. Generally, the Ontario Ministry of Environment Publication NPC-131, "Guidelines for Noise Control in Land-Use Planning" (Reference 3), addresses the noise exposure type of metric, not specifically addressing transit system noise, and transit industry guidelines address the maximum passby noise level. Since the measured ambient noise levels along the proposed alignment, reported in Reference 4 already exceed the MOE guidelines, noise exposure type of criteria is not directly applicable to the Spadina Extension train operations. Also, because of the averaging over time which is characteristics of the noise exposure type of criteria, the maximum passby noise type of limit is more appropriate for transit and other types of periodically recurring noise.

It is important to recognize that the design criteria for maximum airborne noise levels, and for maximum ground-borne noise and vibration levels, as presented herein, address actual maximum levels during passby of a transit train. Thus, the levels indicated can be used directly in design without requiring any assumptions about schedule or number of trains, as is required when criteria are stated in terms of noise exposure levels. Further, the criteria levels are based on community reaction to rail rapid transit train type noise, not on a generalization of noise exposure level criteria for one type of noise to another.

Table 2.2 indicates the criteria for wayside maximum airborne noise from transit trains applicable to the land uses and types of buildings located along the Spadina Subway Extension route. Note that the levels indicated are the average of the maximum sound level occurring as the vehicle passes by, usually a 1 to 4 second averaging period.

2.3 Ground-borne Noise Criteria

Table 2.3 indicates the pertinent criteria for maximum ground-borne noise due to transit train operations applicable to the land uses and types of buildings and occupancies located along the Spadina Subway Extension route. Ground-borne noise which complies with the applicable criteria will not be inaudible in all cases, but should be low enough that no significant intrusion or annoyance will occur.

A range for the maximum ground-borne noise limit is given in some cases to permit the designer to adjust the design criterion to be suitable for the environment and location of the building.

2.4 Ground-borne Vibration Criteria

Because rail transit vehicles also create ground-borne vibration, in addition to noise criteria, limits defining acceptable levels of vibration have been developed. Vibration criteria stated in terms of overall vibration velocity level have been found to be adequate and appropriate for application to new rail transportation systems and provide a basis for assessing potential impact or complaints relative to feelable or audible ground-borne vibration.

Table 2.4 presents the appropriate criteria for the maximum ground-borne vibration for various types of buildings and occupancies in terms of vibration velocity re 1.0 micro in/sec. The criteria apply to the vertical vibration of the ground surface or floor surfaces within the buildings.

Ground-borne vibration which complies with these design criteria will not be imperceptible in all cases; however, the level will be sufficiently low so that no significant intrusion or annoyance should occur. In most cases, there will be vibration from street traffic, other occupants of a building, or other sources, which will create vibration that is equivalent or greater in level than vibration from the transit train passbys.

TABLE 2.1

GENERAL CATEGORIES OF COMMUNITIES ALONG RAIL SYSTEM CORRIDORS

Area Category	Area Description	Typical Ambient Noise Level - dBA Average or L_{50}*	Typical Day/Night Exposure Levels-L_{dn}
I	Low Density urban residential, open space park, suburban residential or quiet recreational area. No nearby highways or boulevards.	40-50 - day 35-45 - night	Below 55
II	Average urban residential, quiet apartments and hotels, open space, suburban residential, or occupied outdoor areas near busy streets.	45-55 - day 40-50 - night	50-60
III	High Density urban residential, average semi-residential/ commercial areas, urban parks, museum, and non-commercial public building areas.	50-60 - day 45-55 - night	55-65
IV	Commercial areas with office buildings, retail stores, etc., primarily daytime occupancy. Central Business Districts.	60-70	Over 60
V	Industrial areas or Freeway and Highway Corridors.	Over 60	Over 65

*L_{50} is the long-term statistical median noise level.

TABLE 2.2

CRITERIA FOR MAXIMUM AIRBORNE NOISE FROM TRAIN OPERATIONS*

Community Area Category	Maximum Passby Noise Level - dBA		
	Single-Family Dwellings	Multi-Family Dwellings	Commercial Buildings
Average Residential	75	75	80
High Density Residential	75	80	85
Commercial	80	80	85

* These criteria are generally applicable at the nearside of the nearest dwelling or occupied building under consideration.

TABLE 2.3

CRITERIA FOR MAXIMUM GROUND-BORNE NOISE FROM TRAIN OPERATIONS

A. Residences and Buildings with Sleeping Areas

Community Area Category	Maximum Passby Ground-Borne Noise Level: Single-Family Dwellings	Multi-Family Dwellings	Hotel/Motel Buildings
Average Residential	35 dBA	40 dBA	45 dBA
High Density Residential	35	40	45
Commercial	40	45	45

B. Special Function Buildings

Type of Building or Room	Maximum Passby Ground-borne Noise Level (dBA)
Offices	35-45
Commercial Buildings	45-55

TABLE 2.4

CRITERIA FOR MAXIMUM GROUND-BORNE VIBRATION FROM TRAIN OPERATIONS*

A. Residences and Buildings with Sleeping Areas

	Maximum Passby Ground-borne Vibration Velocity Level (dB re 10^{-6} in/sec)		
Community Area Category	Single Family Dwellings	Multi-Family Dwellings	Hotel/ Motel Buildings
Average Residential	70	70	75
High Density Residential	70	75	75
Commercial	70	75	75

B. Special Function Buildings

Type of Building or Room	Maximum Passby Vibration Velocity Level (dB re 10^{-6} in/sec)
Offices	75-80
Commercial & Industrial Buildings	75-85

* Criteria apply to the vertical vibration of the ground surface or of floor surfaces within the buildings.

3.0 PROJECTED WAYSIDE AIRBORNE NOISE LEVELS DUE TO RAIL TRANSIT OPERATIONS

To provide a basis for evaluating the expected acoustical impact of subway trains operating along the proposed Spadina Subway Extension route, levels of the expected wayside noise from above ground transit train operations have been projected for each alternative alignment (ie., Alternatives A1 through A6, and B1 and B2). The anticipated noise levels used for our evaluation are based on measured levels for TTC subway trains and other heavy rail transit train vehicles.

The predictions of wayside noise levels to be expected from the subway trains take into account the operational characteristics such as train length, speed, auxiliary equipment noise, acceleration and deceleration, and other features which can affect the wayside noise. It should be noted the subway train noise is primarily a function of speed. There is no significant variation in the noise produced for different operating modes, ie., acceleration, deceleration, coasting, or constant speed.

The basic analysis has been based on 6-car subway trains traveling at a maximum design speed of 80 kph on a standard ballast-and-tie track. At the station areas, a maximum speed of 56 kph has been assumed. Our evaluation has also taken into account the effect of shielding provided by deep open cut areas of the alignment.

An important design feature which contributes to quieter operation is the use of continuous welded rail. Eliminating rail joints eliminates one of the major sources of noise in a steel wheel/rail system. Except at special trackwork locations, it has been assumed that continuous welded rail will be used along the entire alignment. Furthermore, it is assumed that the vehicle wheels and the rails will be maintained in smooth condition.

Table 3.1 summarizes the projected maximum wayside airborne noise levels for each alternative, shown for specific building or groups of buildings. The table also includes the location and direction along the alignment, the type of building structure, the distance from the near track centerline to the nearest buildings under consideration, the maximum train speed for the area, the criteria for allowable levels, based on APTA Guidelines, expected wayside noise levels with and without any recommended sound barrier wall, and any other pertinent information.

In regions where special trackwork is included, such as at crossovers and turnouts, the wheel impact at the frogs, switch points or other discontinuities can significantly increase the radiated noise levels. As such, a correction factor of +6 dBA must be added to the wayside noise levels in order to account for the added wheel/rail noise at the discontinuities at special trackwork sections. The wheel impacts occur with every train passby regardless of train direction or switch position. Our analysis which is indicated "@ special trackwork" assumes that standard frogs will be used at the crossover.

Review of Table 3.1 indicates that there is only one location along Alternatives A4 and A6 where the projected wayside airborne noise levels exceed the appropriate criterion for residential buildings without any noise mitigation measures. The noise criterion is exceeded at about six residential buildings located east of the turnout, near Wilson Station, for Wilson Yard. These residences along Wilson Heights Boulevard are located about 102 m from the special trackwork and without mitigation are expected to experience noise levels of 79 to 81 dBA, exceeding the applicable noise criterion of 75 dBA by a maximum of 6 dBA. To comply with the applicable noise criterion for the residences, a sound barrier wall should be located near the special trackwork. The height of the sound barrier wall should be 1.5 m above top-of-rail and the wall should be extended about 15 m beyond both ends of the special trackwork. With the recommended sound barrier wall, the noise levels will be reduced to a maximum of 73 dBA, complying with the applicable noise criterion. If it is determined during the preliminary engineering that the top edge of Allen Road provides the required noise reduction, the sound barrier wall may be eliminated. The sound barrier wall could also be eliminated with the use of a "moveable point" switch frog or a "spring loaded" frog which is normally closed and which would reduce the increase in wayside airborne noise.

For Alternatives A1 through A3, A5, B1 and B2, the projected wayside airborne noise levels are expected to comply with the applicable noise criterion without applying any special mitigation measures.

TABLE 3.1 SUMMARY OF PROJECTED AIRBORNE NOISE LEVELS FROM TRANSIT TRAIN OPERATIONS ALONG THE SPADINA SUBWAY EXTENSION

Location and Direction from Alignment	Type of Structure (N)*	Horizontal Distance to Nearest Buildings from Centerline of Near Track (m)	Maximum Train Speed (kph)	Criterion for Allowable Passby Noise (dBA)	No Sound Barrier Wall		Sound Barrier Wall		
					Projected Maximum Noise Level (dBA)	Required Distance for Criterion Compliance (m)	Projected Maximum Noise Level (dBA)	Required Distance for Criterion Compliance (m)	Length of Recommended Sound Barrier Wall (m)
ALIGNMENT A1									
Alignment between Wilson Station and end of Wilson Yard									
Northbound	Single-Family Residential (11)	102-330	80	75	62-75	–	–	–	–
		330	50 @ special trackwork	75	68-70	–	–	–	–
Alignment between end of Wilson Yard and Reimer Road									
Northbound	Single-Family Residential (16)	250-480	80	75	<67	–	–	–	–
Southbound	Industrial (2-M.A.D. House and D.N.D. Explosive Storage)	112-120	80	85	<65	–	–	–	–
Beyond Reimer Road alignment is in a subway									
ALIGNMENT A2									
Alignment between Wilson Station and end of Wilson Yard									
Northbound	Single-Family Residential (11)	102-330	80	75	62-75	–	–	–	–
		330	80 @ special trackwork	75	68-70	–	–	–	–
Alignment between end of Wilson Yard and Reimer Road									
Northbound	Single-Family Residential (16)	235-485	80	75	<67	–	–	–	–

TABLE 3.1 (continued)

					No Sound Barrier Wall		Sound Barrier Wall		
Location and Direction from Alignment	Type of Structure (N)*	Horizontal Distance to Nearest Buildings from Centerline of Near Track (m)	Maximum Train Speed (kph)	Criterion for Allowable Passby Noise (dBA)	Projected Maximum Noise Level (dBA)	Required Distance for Criterion Compliance (m)	Projected Maximum Noise Level (dBA)	Required Distance for Criterion Compliance (m)	Length of Recommended Sound Barrier Wall (m)
Alignment between Reimer Road and Sheppard Avenue in a subway and deep cut									
Northbound	Single-Family Residential (4)	270	80@ special trackwork	75	<62	–	–	–	–
Southbound	Industrial (3-M.A.D. House, D.N.D. Explosive Storage and Warehouse)	210-220	80	85	<60	–	–	–	–
		230-260	80@ special trackwork	85	<63	–	–	–	–
Beyond Sheppard Avenue Alignment in a subway									
ALIGNMENT A3									
Alignment between Wilson Station and end of Wilson Yard									
Northbound	Single-Family Residential (11)	102-330	80	75	62-75	–	–	–	–
		330	80@ special trackwork	75	68-70	–	–	–	–
Beyond Wilson Yard Alignment in a subway and deep cut									
ALIGNMENT A4									
Alignment between Wilson Station and beginning of Wilson Yard									
Northbound	Single-Family Residential (2)	102	80@ special trackwork	75	79-81	190	71-73	–	Extend 15m beyond both ends of special trackwork

TABLE 3.1 (continued)

Location and Direction from Alignment	Type of Structure (N)*	Horizontal Distance to Nearest Buildings from Centerline of Near Track (m)	Maximum Train Speed (kph)	Criterion for Allowable Passby Noise (dBA)	No Sound Barrier Wall		Sound Barrier Wall		
					Projected Maximum Noise Level (dBA)	Required Distance for Criterion Compliance (m)	Projected Maximum Noise Level (dBA)	Required Distance for Criterion Compliance (m)	Length of Recommended Sound Barrier Wall (m)
Alignment between beginning and end of Wilson Yard (alignment in an open cut and a subway)									
Northbound	Single-Family Residential (10)	80-225	80	75	66-75	-	-	-	-
Alignment between end of Wilson Yard and Reimer Road (alignment at-grade and in a cut)									
Northbound	Single-Family Residential (16)	175-390	80	75	<70	-	-	-	-
Alignment between Reimer Road and Sheppard Avenue (alignment in a deep cut and subway)									
Northbound	Single-Family Residential (6)	215-270	80	75	<60	-	-	-	-
Southbound	Industrial (3-M.A.D House, D.N.D. Explosive Storage and Workshop)	220-230	80	85	<60	-	-	-	-
Beyond Sheppard Avenue Alignment in a subway									
ALIGNMENT A5									
Alignment between Wilson Station and end of Wilson Yard									
Northbound	Single-Family Residential (11)	102-330	80	75	62-75	-	-	-	-
		330	80@ special trackwork	75	68-70	-	-	-	-

TABLE 3.1 (continued)

					No Sound Barrier Wall		Sound Barrier Wall		
Location and Direction from Alignment	Type of Structure (N)*	Horizontal Distance to Nearest Buildings from Centerline of Near Track (m)	Maximum Train Speed (kph)	Criterion for Allowable Passby Noise (dBA)	Projected Maximum Noise Level (dBA)	Required Distance for Criterion Compliance (m)	Projected Maximum Noise Level (dBA)	Required Distance for Criterion Compliance (m)	Length of Recommended Sound Barrier Wall (m)
Alignment between end of Wilson Yard and Reimer Road (alignment in a cut and subway)									
Northbound	Single-Family Residential (16)	160-360	80	75	<64	–	–	–	–
Alignment between Reimer Road and Sheppard Avenue (alignment in a cut and subway)									
Northbound	Single-Family Residential (6)	215-270	80	75	<60	–	–	–	–
	Industrial (3- M.A.D. House, D.N.D. Explosive Storage and Workshop)	220-230	80	85	<60	–	–	–	–
Beyond Sheppard Avenue alignment in a subway									
ALIGNMENT A6									
Alignment between Wilson Station and beginning of Wilson Yard									
Northbound	Single-Family Residential (2)	102	80@ special trackwork	75	79-81	190	71-73	–	Extend 15m beyond both ends of special trackwork
Alignment between beginning and end of Wilson Yard (alignment at-grade, and in a cut and subway)									
Northbound	Single-Family Residential (10)	80-225	80	75	58-75	–	–	–	–
Alignment between end of Wilson Yard and Sheppard Avenue (alignment at-grade and in a subway)									
Northbound	Single-Family Residential (22)	185-400	80	75	67-69	–	–	–	–

TABLE 3.1 (continued)

Location and Direction from Alignment	Type of Structure (N)*	Horizontal Distance to Nearest Buildings from Centerline of Near Track (m)	Maximum Train Speed (kph)	Criterion for Allowable Passby Noise (dBA)	No Sound Barrier Wall		Sound Barrier Wall		
					Projected Maximum Noise Level (dBA)	Required Distance for Criterion Compliance (m)	Projected Maximum Noise Level (dBA)	Required Distance for Criterion Compliance (m)	Length of Recommended Sound Barrier Wall (m)
Southbound	Industrial (3- M.A.D. House, D.N.D. Explosive Storage and Workshop)	165-185	80	85	67-70	–	–	–	–
Beyond Sheppard Avenue alignment in a subway									
ALIGNMENT B1									
Alignment between Wilson Station and end of Wilson Yard									
Northbound	Single-Family Residential (11)	102-330	80	75	62-75	–	–	–	–
		290	80@ special trackwork	75	70-72	–	–	–	–
Alignment between end of Wilson Yard and Reimer Road (alignment at-grade, and in a cut and subway)									
Northbound	Single-Family Residential (6)	400-500	80	75	<64	–	–	–	–
Alignment between Reimer Road and Sheppard Avenue is in a subway									
ALIGNMENT B2									
Alignment between Wilson Station and end of Wilson Yard									
Northbound	Single-Family Residential (11)	102-330	80	75	62-75	–	–	–	–
		290	80@ special trackwork	75	70-72	–	–	–	–

TABLE 3.1 (continued)

Location and Direction from Alignment	Type of Structure (N)*	Horizontal Distance to Nearest Buildings from Centerline of Near Track (m)	Maximum Train Speed (kph)	Criterion for Allowable Passby Noise (dBA)	No Sound Barrier Wall		Sound Barrier Wall		
					Projected Maximum Noise Level (dBA)	Required Distance for Criterion Compliance (m)	Projected Maximum Noise Level (dBA)	Required Distance for Criterion Compliance (m)	Length of Recommended Sound Barrier Wall (m)
Alignment between end of Wilson Yard and Reimer Road (alignment at-grade, and in a cut and subway									
Northbound	Single-Family Residential (16)	190-450	80	75	60-69	-	-	-	-
		200	80@ special trackwork	75	73-75	-	-	-	-
Beyond Reimer Road alignment in a subway									

(N) = Number of Buildings ±10%

4.0 PROJECTED GROUND-BORNE NOISE AND VIBRATION LEVELS DUE TO RAIL TRANSIT OPERATIONS

Operations of subway rail transit systems results in ground-borne vibration which is transmitted from the track structure to the adjacent buildings via the intervening geologic strata. The ground-borne vibration originates at the wheel/rail interface and is due to the vibration generated by the wheels rolling on the rails. The level of this vibration at the source is influenced by the degree of roughness or smoothness of the wheels and rails, the stiffness of the transit vehicle primary suspension, the speed of the train, the type of track fixation, and by the geologic strata in which the alignment is situated.

Inside nearby buildings, if the airborne components of noise from a transit train is sufficiently attenuated, then ground-borne noise can be perceived as a low-pitched rumbling noise radiated inside the building structure by the ground-borne induced vibration of the building's walls, floors and ceilings. However, for above ground train operations along the Spadina Subway Extension, the airborne noise is expected to be of sufficient level to mask the ground-borne noise and the only potential impact from ground-borne vibration is the perception of low frequency, low level mechanical motion.

It should be noted that the wayside vibration is of such a low level that there is no possibility or potential for structural damage due to the ground-borne vibration transmitted to buildings near the alignment.

Similar to the case with wayside noise, standard switch frogs normally used at crossovers, due to the inherent gap, are sources of high levels of ground-borne vibration, generating 6 to 10 dB higher vibration levels as compared with operation on adjacent standard continuous trackwork. To achieve acceptable levels of ground-borne vibration in buildings close to rail alignments, it is necessary to locate crossovers as far from vibration sensitive buildings (e.g., residences, hospitals) as practical, preferably in industrial or undeveloped areas.

The basis for evaluating expected ground-borne noise and vibration impact along each alternative alignment is the actual operational data measured extensively along the Yonge Subway Northern Extension and along the Bloor-Danforth Subway, reported in References 5 through 8. Our prediction methodology has taken into account estimated soil-to-foundation coupling loss for the building and amplification due to floor resonances, rail discontinuities at crossover and turnout special trackwork, train speed and any vibration control measures. The end result is the estimated vibration levels of the room surfaces and ground-borne noise within the room, which can then be compared to the applicable criteria to determine the acceptability of the ground-borne noise and vibration.

The analysis is based on 6-car subway trains traveling at a speed of 80 kph on standard track with standard TTC resilient direct fixation (DF) fasteners in a concrete double-box subway. For above ground sections of the alignments, standard ballast-and-tie track has been assumed for our evaluation. At the station areas, maximum speed of 56 kph has been assumed.

In areas where ground-borne noise and vibration along the subway section of the alignment is projected to exceed the applicable criteria, we have assumed the use of a floating slab track (ie., double tie trackbed system) the standard vibration mitigation measure in TTC subways. Since the above ground sections of the route are at a considerable distant from the sensitive structures, vibration mitigation measures are not necessary or assumed in our evaluation.

Table 4.1 summarizes the projected maximum ground-borne noise and vibration levels from 6-car train passbys. As was done for the wayside airborne noise predictions, the closest building or group of buildings to the alignment is used to make projections of ground-borne noise and vibration. The table also shows the applicable ground-borne noise and vibration acceptability criteria, type of structure, direction of the track, distance from the centerline of the near track, operational train speed and any other pertinent information. Where necessary, the table also indicates the projected ground-borne noise and vibration levels with the use of double tie trackbed system.

Since the ground-borne noise levels are expected to be masked by the wayside airborne noise levels for the above ground transit train operations, ground-borne noise projections have been estimated only for subway sections of the alignment. Because the new station along Alternative B2 is at a considerable distance from Sheppard Avenue, we have not analyzed Alternative B2 alignment beyond 300 m from the end of the platform.

The projected ground-borne noise and vibration levels have taken into consideration increase in vibration levels of 10 dB as the train passes over the rail discontinuities at the crossover and turnout special trackwork. The analysis which is indicated "@ special trackwork" assumes that standard frogs will be used at the crossover and turnout.

Review of Table 4.1 indicates that the subway train operations along some of the proposed alignments will generate ground-borne noise levels that will be unacceptable at two locations where the tracks will be located in close proximity to the residential dwellings. The ground-borne vibration impact will be unacceptable at only one location. In order to reduce levels and avoid impact at the affected structures, the double tie trackbed system must be used in the subway.

Along Alternative B1 alignment, double tie trackbed system is necessary to reduce ground-borne vibration impact at about 16 residences along Sheppard Avenue, located beyond the end of the station platform on both sides of the track. These residences are located at a distance of between 10 and 40 m from the near track. The projected maximum ground-borne vibration level at these residential structures without any mitigation is about 75 dB, exceeding the appropriate vibration criterion of 70 dB by 5 dB. With the double tie trackbed system in the subway, the vibration level will be reduced to a maximum of 63 dB, complying with the applicable ground-borne vibration criterion. The vibration mitigation is only required beyond the end of the station platform. Due to slower train speed at the station area, and due to greater distance between the tracks and the residences near the station area, ground-borne vibration levels at the residences near the station area are expected to comply with the appropriate vibration criterion either with or without the double tie trackbed. Even so, it is recommended the double tie system be used through the Station.

For Alternatives A1 through A6 and B2, vibration levels at the sensitive structures due to the subway trains is expected to comply with the applicable criterion with standard trackwork and trackbed.

As indicated earlier, there are only two locations where ground-borne noise levels are expected to exceed the applicable criterion. The first area is along Alignment B1, affecting the same 16 residences where without mitigation ground-borne vibration impact is anticipated. The projected maximum ground-borne noise level at the residential structures without any mitigation is about 45 dBA, exceeding the appropriate ground-borne noise criterion by a maximum of 9 dBA. With the double tie trackbed system, the ground-borne noise will be reduced to a maximum of 33 dBA, complying with the applicable ground-borne noise criterion of 35 dBA for the residences.

The second area where double tie trackbed system must be used is beyond the end of the new station platform for Alternatives A2, A4 and A5 to mitigate ground-borne noise impact at about 15 single-family residential structure located about 33 to 55 m from the near track. Without any vibration mitigation, the projected maximum ground-borne noise level is 38 dBA, exceeding the applicable ground-borne noise criterion of 35 dBA by 3 dBA. With the double tie trackbed system, the ground-borne noise impact will be reduced to a maximum of 26 dBA, complying with the applicable ground-borne noise criterion and avoiding any impact.

For Alternatives A1, A3, A6 and B2, ground-borne noise levels are expected to comply with the applicable ground-borne noise criterion without any special mitigation measures.

TABLE 4.1 SUMMARY OF PROJECTED MAXIMUM GROUND-BORNE NOISE AND VIBRATION LEVELS FROM TRANSIT TRAIN OPERATIONS ALONG THE SPADINA SUBWAY EXTENSION.

				Ground-Borne Noise			Ground-Borne Vibration		
Location and Direction from Alignment	Type of Structure (N)	Horizontal Distance From Near Track (m)	Operational Train Speed (kph)	Criterion for Allowable Noise Level (dBA)	Projected Maximum Noise Level with Standard Fasteners (dBA)	Projected Maximum Noise Level with Double Tie Track (dBA)	Criterion for Allowable Vibration Level (dB)**	Projected Maximum Vibration Velocity Level with Standard Fasteners (dB)**	Projected Maximum Vibration Velocity Level with Double Tie Track (dB)**
ALIGNMENT A1									
Alignment between Wilson Station and Reimer Road									
Northbound	Single-Family Residential (27)	102-480	80	-	-	-	70	<60	-
		330	80@ special trackwork	-	-	-	70	<60	-
Southbound	Industrial (2-M.A.D. House and D.N.D. Explosive Storage)	112-120	80	-	-	-	80	<58	-
Alignment between Reimer Road and Sheppard Avenue									
Northbound	Single-Family Residential (6)	330-350	80	35	<20	-	70	<56	-
Southbound	Industrial (1-D.N.D. Workshop)	150	80	50	<25	-	80	<57	-
Alignment between Sheppard Avenue and 250 m beyond end of station platform									
Northbound	Single-Family Residential (20)	70	80	35	30-35	-	70	60-65	-
	Commercial (2)	70	80	50	30-35	-	80	60-65	-
Southbound	Commercial (1)	32	80	50	32-37	-	80	62-67	-

TABLE4.1 (continued)

Location and Direction from Alignment	Type of Structure (N)	Horizontal Distance From Near Track (m)	Operational Train Speed (kph)	Ground-Borne Noise: Criterion for Allowable Noise Level (dBA)	Ground-Borne Noise: Projected Maximum Noise Level with Standard Fasteners (dBA)	Ground-Borne Noise: Projected Maximum Noise Level with Double Tie Track (dBA)	Ground-Borne Vibration: Criterion for Allowable Vibration Level (dB)**	Ground-Borne Vibration: Projected Maximum Vibration Velocity Level with Standard Fasteners (dB)**	Ground-Borne Vibration: Projected Maximum Vibration Velocity Level with Double Tie Track (dB)**
ALIGNMENT A2									
Alignment between Wilson Station and Reimer Road									
Northbound	Single-Family Residential (27)	102-480	80	35	<30	–	70	<60	–
		330	80@ special trackwork	–	–	–	70	<60	–
Southbound	Industrial (2-M.A.D. House and D.N.D. Explosive Storage)	205	80	50	<25	–	80	<55	–
Alignment between Reimer Road and Sheppard Avenue									
Northbound	Single-Family Residential (6)	260-275	80	35	<25	–	70	<55	–
		275	80@ special trackwork	35	<30	–	70	<60	–
Southbound	Industrial (1-D.N.D. Workshop)	220	80	50	<25	–	80	<55	–
Alignment between Sheppard Avenue and 300m beyond end of station platform									
Northbound	Single-Family Residential (20)	33-55	64-80 (lower speed near sta.)	35	31-38	<26	70	61-68	–
	Commercial (2)	25	64 (near sta.)	50	35-40	–	80	65-70	–
Southbound	Commercial (1)	58	80	50	28-33	–	80	58-63	–

TABLE 4.1 (continued)

				Ground-Borne Noise			Ground-Borne Vibration		
Location and Direction from Alignment	Type of Structure (N)	Horizontal Distance From Near Track (m)	Operational Train Speed (kph)	Criterion for Allowable Noise Level (dBA)	Projected Maximum Noise Level with Standard Fasteners (dBA)	Projected Maximum Noise Level with Double Tie Track (dBA)	Criterion for Allowable Vibration Level (dB)**	Projected Maximum Vibration Velocity Level with Standard Fasteners (dB)**	Projected Maximum Vibration Velocity Level with Double Tie Track (dB)**
ALIGNMENT A3									
Alignment between Wilson Station and Sheppard Avenue									
Northbound	Single-Family Residential (33)	102-500	80	35	<30	-	70	<60	-
		330	80@ special trackwork	-	-	-	70	<60	-
Southbound	Industrial (3-M.A.D. House, D.N.D. Explosive Storage and Workshop)	75-110	80	50	<30	-	80	<60	-
Alignment between Sheppard Avenue and 150m beyond end of station platform									
Northbound	Single-Family Residential (20)	82	64-80 (lower speed near sta.)	35	26-34	-	70	56-64	-
	Commercial (2)	100	56 (near sta.)	50	<25	-	80	<55	-
Southbound	Commercial (1)	18	80	50	36-41	-	80	66-71	-
ALIGNMENT A4									
Alignment between Wilson Station and Sheppard Avenue									
Northbound	Single-Family Residential (33)	102-390	80	35	<30	-	70	<60	-
		102-390	80@ special trackwork	-	-	-	70	<67	-
Southbound	Industrial (3-M.A.D. House, D.N.D. Explosive Storage and Workshop)	220-230	80	-	-	-	80	<55	-

TABLE 4.1 (continued)

Location and Direction from Alignment	Type of Structure (N)	Horizontal Distance From Near Track (m)	Operational Train Speed (kph)	Ground-Borne Noise			Ground-Borne Vibration		
				Criterion for Allowable Noise Level (dBA)	Projected Maximum Noise Level with Standard Fasteners (dBA)	Projected Maximum Noise Level with Double Tie Track (dBA)	Criterion for Allowable Vibration Level (dB)**	Projected Maximum Vibration Velocity Level with Standard Fasteners (dB)**	Projected Maximum Vibration Velocity Level with Double Tie Track (dB)**
Alignment between Sheppard Avenue and 300m beyond end of station platform									
Northbound	Single-Family Residential (20)	33-55	64-80 (lower speed near sta.)	35	31-38	<26	70	61-68	–
	Commercial (2)	25	64 (near sta.)	50	35-40	–	80	65-70	–
Southbound	Commercial (1)	58	80	50	28-33	–	80	58-63	–
ALIGNMENT A5									
Alignment between Wilson Station and Sheppard Avenue									
Northbound	Single-Family Residential (33)	102-375	80	35	<30	–	70	<60	–
		330	80@ special trackwork	–	–	–	70	<60	–
Southbound	Industrial (3-M.A.D. House D.N.D. Explosive Storage and Workshop)	220-230	80	–	–	–	80	<55	–
Alignment between Sheppard Avenue and 300m beyond end of station platform									
Northbound	Single-Family Residential (20	33-55	64-80 (lower speed near sta.)	35	31-38	<26	70	61-68	–
	Commercial (2)	25	64 (near sta.)	50	35-40	–	80	65-70	–
Southbound	Commercial (1)	58	80	50	28-33	–	80	58-63	–

TABLE 4.1 (continued)

Location and Direction from Alignment	Type of Structure (N)	Horizontal Distance From Near Track (m)	Operational Train Speed (kph)	Ground-Borne Noise: Criterion for Allowable Noise Level (dBA)	Ground-Borne Noise: Projected Maximum Noise Level with Standard Fasteners (dBA)	Ground-Borne Noise: Projected Maximum Noise Level with Double Tie Track (dBA)	Ground-Borne Vibration: Criterion for Allowable Vibration Level (dB)**	Ground-Borne Vibration: Projected Maximum Vibration Velocity Level with Standard Fasteners (dB)**	Ground-Borne Vibration: Projected Maximum Vibration Velocity Level with Double Tie Track (dB)**
ALIGNMENT A6									
Alignment between Wilson Station and Sheppard Avenue									
Northbound	Single-Family Residential (33)	102-390	80	35	<30	-	70	<60	-
		102	80@ special trackwork	-	-	-	70	<67	-
Southbound	Industrial (3-M.A.D. House, D.N.D. Explosive Storage and Workshop)	165-180	80	-	-	-	80	<55	-
Alignment between Sheppard Avenue and 340m beyond end of station platform									
Northbound	Single-Family Residential (20)	65	80	35	30-35	-	70	60-65	-
	Commercial (2)	65	64 (near station)	50	28-33	-	80	58-63	-
Southbound	Commercial (1)	40	80	50	30-35	-	80	60-65	-
ALIGNMENT B1									
Alignment between Wilson Station and Reimer Road									
Northbound	Single-Family Residential (27)	102-500	80	35	<30	-	70	<60	-
		300	80 @ special trackwork	-	-	-	70	<60	-
	Industrial (2-M.A.D. House and D.N.D. Explosive Storage)	240	80	50	<25	-	80	<55	-

TABLE 4.1 (continued)

				Ground-Borne Noise			Ground-Borne Vibration		
Location and Direction from Alignment	Type of Structure (N)	Horizontal Distance From Near Track (m)	Operational Train Speed (kph)	Criterion for Allowable Noise Level (dBA)	Projected Maximum Noise Level with Standard Fasteners (dBA)	Projected Maximum Noise Level with Double Tie Track (dBA)	Criterion for Allowable Vibration Level (dB)**	Projected Maximum Vibration Velocity Level with Standard Fasteners (dB)**	Projected Maximum Vibration Velocity Level with Double Tie Track (dB)**
Alignment between Reimer Road and intersection of Sheppard Avenue and Allen Road									
Northbound/ Southbound	Industrial (1-D.N.D. Workshop)	0 (assumed t.o.r. 10 m below ground)	80	50	38-43	-	80	68-73	-
Alignment between Allen Road and Banting Street									
Northbound	Single-Family Residential (1)	18	80	35	38-43	26-31	70	68-73	56-61
Southbound	Commercial (2)	65	56 (near station)	50	26-31	-	80	56-61	-
	Multi-Family Residential (1)	50	56 (near station)	40	29-34	-	75	59-64	-
	Single-Family Residential (11)	18-24	56-80 (lower speed near station)	35	30-44	18-22	70	60-74	58-62
Alignment along Sheppard Avenue, about 50 m beyond Banting Street									
Northbound/ Southbound	Single-Family Residential (7)	10	80	35	40-45	28-32	70	70-75	58-63

TABLE 4.1 (continued)

				Ground-Borne Noise			Ground-Borne Vibration		
Location and Direction from Alignment	Type of Structure (N)	Horizontal Distance From Near Track (m)	Operational Train Speed (kph)	Criterion for Allowable Noise Level (dBA)	Projected Maximum Noise Level with Standard Fasteners (dBA)	Projected Maximum Noise Level with Double Tie Track (dBA)	Criterion for Allowable Vibration Level (dB)**	Projected Maximum Vibration Velocity Level with Standard Fasteners (dB)**	Projected Maximum Vibration Velocity Level with Double Tie Track (dB)**
ALIGNMENT B2									
Alignment between Wilson Station and Reimer Road									
Northbound	Single-Family Residential (27)	102-500	80	35	<30	-	70	<60	-
		200-300	80 @ special trackwork	-	-	-	70	<60	-
	Industrial (2-M.A.D. House and D.N.D. Explosive Storage)	250	80	50	<25	-	80	<55	-
Alignment between Reimer Road and 300 m beyond end of station platform (alignment heading along Sheppard Avenue or along Allen Road)									
Northbound	Single-Family Residential (11)	70-210	80	35	<34	-	70	<64	-
	Multi-Family Residential (1)	60-110	80	40	<35	-	75	<65	-

(N) = Number of Buildings ± 10%

**** = dB re 1 micro in/sec**

5.0 CONSTRUCTION NOISE AND VIBRATION IMPACT

A potential impact associated with a rail rapid transit system project is the short-term effect of noise and vibration from construction activities. As with any large project, the construction of a rapid transit system involves the use of machines and procedures which, in the past, have resulted in intense noise levels and occasionally, high vibration levels in and around the construction site.

The control of noise and vibration during the construction of a Spadina Subway Extension alignment is important in minimizing adverse impact on the neighboring community. This is particularly true because sections of the proposed rail alignments are located very close to a number of existing residential buildings.

There are numerous procedures available for reducing the noise generated by construction equipment activities. One of the most effective methods of assuring controlled noise and minimum acoustic impact is the inclusion of noise limit specifications in the construction contract documents. Recent construction projects of WMATA, NYCTA, BRRT and MARTA systems have included noise restrictions in the contract specifications.

Inclusion of noise and vibration control specifications in construction contract documents is recommended to assist in minimizing intrusion during the construction phase of the project.

6.0 REFERENCE AND BIBLIOGRAPHY

1. "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety", United States Environmental Protection Agency, EPA Technical Document 500/9-74-004, March 1974.

2. "Guidelines for Design of Rapid Transit Facilities", Report by American Public Transit Association (APTA), January 1979.

3. "Model Municipal Noise Control By-Law", Final Report, Ontario Ministry of the Environment, August 1978.

4. "Sound Measurement Results, Spadina Subway Extension", letter prepared by Valcoustics Canada Ltd. for Delcan Corporation, 10 November 1989.

5. "Yonge Subway Northern Extension Noise and Vibration Study", Toronto Transit Commission Report RD 115/2, October 1976.

6. "Yonge Subway Northern Extension Noise and Vibration Study", Toronto Transit Commission Report RD 115/4, October 1976.

7. "Toronto's Double Tie Trackbed System", paper presented by S. T. Lawrence at the APTA Rapid Transit Conference in Chicago, June 5-8, 1978.

8. "TTC Track Vibration Isolation System", Toronto Transit Commission Engineering Department, 1978.

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4 April 1990

Mr. Lynton Erskine
DELCAN Corporation
133 Wynford Drive
North York, Ontario M3C 1K1
CANADA

Subject: Supplement to 9 March 1990 Noise and Vibration
Impact Assessment Report Re:
Spadina Subway Extension Project

Dear Mr. Erskine:

As requested, this letter presents information supplementing the Spadina Subway Extension Project Noise and Vibration Impact Assessment Report submitted 9 March 1990.

1. Ground-Borne Vibration Criteria

> The ground-borne vibration criteria presented in Table 2.4 of the Report were originally developed for use in assessing potential impact of tactily perceptible ground-borne vibration from rail transit trains at residential and other types of buildings. The criteria were developed because of the finding that use of ground-borne noise limits alone was not sufficient to assure there would be no impact due to tactily perceptible vibration at lower frequencies.
>
> The criteria stated were first used for environmental assessment and design purposes in the late 1970's and were first published in 1980, reference attached. They have come into use for rapid transit system environmental assessment and design purposes throughout North America during the past decade. The criteria developed are similar to the internationally accepted standards for acceptability of human exposure to vibration in buildings as given in British Standard BS-6472 and International Standard ISO-2631 except that experience has shown these standards to be somewhat too high for quiet residential dwellings such as single-family dwellings.
>
> The criteria in Table 2.4 of the Report provide for 5 dB less allowable vibration level for critical residential areas than are indicated for residential buildings in the International and British Standards. Experience with ground-borne vibration from rail transit trains in North America has indicated that this lower level is

required in order to avoid significant impact from perceptible vibration in quiet residential environments.

2. Alternative A3 Integrated Office Tower Development

   For Alternative A3, the integration of the station structure with the office tower over the concourse will require the double-tie floating slab track to reduce the vibration and noise levels from the trains to satisfactory levels in the office tower. The degree of reduction of noise and vibration produced by the double-tie floating slab track will be sufficient to preclude the need for any structural isolation of the office tower from the station structure. Therefore, it is not necessary to consider additional vibration isolation other than the standard double-tie track support system for Alternative A3.

3. Defence Department Explosive Storage Buildings

   The Defence Department has no definite vibration standards for the materials stored at the M.A.D. House and D.N.D. Explosive Storage Building. However, it has been indicated that the materials stored are capable of withstanding the vibration experienced during transport in normal road and rail vehicles. The vibration levels produced in transport vehicles are of much greater amplitude than the ground-borne vibration created by subway trains. Even if the subway structure were to be located within 5 m of the buildings, which could result in vibration velocity at the buildings of up to 0.5 mm/sec, the vibration would be much less than experienced during transport. The normally expected range of vibration in transport vehicles is on the order of 10 to 100 mm/sec or greater. Thus, the ground-borne vibration from the subway train operations will not present any danger or impact to the materials stored at the M.A.D. House and D.N.D. Explosive Storage Building, which are located near some of the proposed alternative alignments.

Very truly yours,

WILSON, IHRIG & ASSOCIATES, INC.

George Paul Wilson

George Paul Wilson, Ph.D.

Encl.

GPW:mlw

REFERENCE

"Criteria for Acceptable Levels of Building Vibration Caused by Rapid Transit Operations" by Hugh J. Saurenman, 19th meeting of the Acoustical Society of America, April, 1980.

APPENDIX 6.1

CORRESPONDENCE FROM DEPARTMENT OF NATIONAL DEFENCE

National Defence Defense nationale

11300-1 (BTSO)
7625-0178-PF 6090

Canadian Forces Base Toronto
North York, Ontario
M3K 1Y6

15 June 1990

Mr. Lynton Erskine
Project Manager
Delcan Corporation
133 Wynford Drive
North York, Ontario
M3C 1K1

Dear Mr. Erskine:

AMMUNITION STORAGE FACILITIES - CFB TORONTO

This letter will confirm that the Department of National Defence has now scheduled the replacement of existing ammunition storage facilities for fiscal year 1992/93. It is expected that the new facilities will be occupied in March 1993. The new facilities will be designed to totally contain horizontal blast in the unlikely event of an accident.

Should you have further questions, please do not hesitate to contact Major Grant Clarke at 416-635-4764.

Yours truly,

B.S. Gateley
Lieutenant-Colonel
for Base Commander

Canada